[*Crown Copyright Reserved.*

ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

[Nos. 7 & 8] [1917

XXVII.—A LIST OF ECONOMIC PLANTS NATIVE OR SUITABLE FOR CULTIVATION IN THE BRITISH EMPIRE.

The editor of the *Kew Bulletin* has very kindly asked me to write a few words of introduction to the List of Economic Plants, which comprises the present double number of the *Bulletin*, with a view to explaining its origin and object.

In response to the invitation of the Council of the British Association the Sectional Committees met early in last year to consider what could be done in their respective Sections to meet problems which would arise after the war. Among the suggestions which were considered by the Committee of Section K (Botany), in a meeting at which I had the honour to preside, was one embracing the more extended and thorough study of those plants of economic value which are native or capable of being cultivated in Great Britain or other parts of the Empire. It was recognised that economic plants and their uses afforded opportunity for botanical investigation from many points of view and in this connection a list of the plants classified according to their uses was a desideratum. Sir David Prain, who took part in the discussion, kindly undertook to have such a list prepared, from the sources available at Kew, for the information of the members of the Committee. The list having been prepared, its great value and importance at once indicated that it should be made widely available for botanists and others interested in economic botany. The Director of the Royal Botanic Gardens was asked, and agreed, to publish it as a number of the *Kew Bulletin*, and it was suggested that an additional number of copies might be supplied to the British Association for distribution by the Botanical Committee. The Committee of Section K welcomed this suggestion, and its recommendation was accepted by the Council and General Committee. Owing to the temporary suspension of the *Bulletin* the publication of the List has been deferred until now.

The List is of great interest. It not only indicates the large number of plants which are already recognised as of practical economic use and capable of being grown or cultivated in

(5070.) Wt. 152—699. 1,125. 11/17. J. T. & S., Ltd. G. 14. Sch. 12.

different parts of our Empire, but is also full of suggestion for possibilities of development. The botanist who wishes to work at a problem which may yield results of economic value will find numerous hints in the following pages. There is ample opportunity for work on physiological, chemical, anatomical or taxonomic lines; and there are also problems which should interest the Mendelian. The remarkable differences in yield of the economic product in closely allied species, or in varieties and forms of one and the same species, or in plants of the same form when grown under different conditions of climate or soil, afford subjects for investigation. The systematist may do good service by monographic study of such groups, and by careful diagnosis of the species and varieties may enable the man in the field to discriminate the more valuable forms from those which are of less value for his purpose. There are many instances where the specific identity of the useful plant is unknown; the botanical collector may solve such problems, and also increase our knowledge of the habitat and range of distribution of useful plants, as well as add to their number. To the botanist who is willing to help on matters after the war by taking up work which directly or indirectly may be of economic value this Kew List indicates many paths of widely varying interest.

The List will also be useful for general reference. Botanists associated with various institutions frequently receive queries of an economic nature which are answered with some difficulty or only at the cost of a search through very scattered literature. Probably most of these queries could be easily answered at Kew, but it will be a saving of time and labour all round to have the information, now supplied by the List, ready to hand and thus to render available for workers at home and abroad an epitome of the knowledge which has been gathered together at one centre.

A. B. Rendle.

FATTY OILS.

In addition to extracted oil large quantities of Nuts and Kernels for the extraction of oil are imported. In 1913, unenumerated Oil Seeds and Kernels to the weight of 9,087 tons, valued at £172,861 were imported from Foreign Countries, and in the same year 41,165 tons of Oil Seeds and Kernels valued at £863,484 were imported from British Possessions. Copra was not included in these returns, the weight of Copra imported from Foreign Countries in 1913 being 6,154 tons, valued at £177,885. In the same year British Possessions supplied 24,714 tons of Copra valued at £718,822.

Coco-nut (*Cocos nucifera*, *L.*).

British.—India, Straits Settlements and Dependencies, Australia, New Zealand, British West Indian Islands, &c.

Foreign.—French Possessions in the Pacific, Philippine Islands, &c.

The dried meat of the nut (Copra) is imported from these countries and the oil extracted here. But in addition a large

quantity of refined and unrefined oil is imported. The imports of Copra are given above. The imports of Coco-nut Oil for 1913 were as follows:

	Cwts.	Value. £
FOREIGN—		
Refined	537,939 ...	1,296,619
Unrefined	435,227 ...	939,128
BRITISH—		
Refined	8,803 ...	19,627
Unrefined	187,574 ...	403,341

The Foreign Countries principally concerned with the oil were:—

	Refined. Cwts.	Unrefined. Cwts.
Denmark	66,004 ...	21,289
Germany	210,604 ...	397,016
Belgium	53,675 ...	6,370
France	194,556 ...	9,610

The British Possessions chiefly interested were:—

	Refined. Cwts.	Unrefined. Cwts.
India	222 ...	20,089
Ceylon	8,516 ...	140,771
Australia	65 ...	26,714

African Oil Palm (*Elaeis guineensis*, Jacq.).

BRITISH.—Sierra Leone, Gold Coast, Southern Nigeria, &c. FOREIGN.—Germany, German West Africa, French West Africa, Portuguese West Africa, Liberia, &c.

The Imports and Values of African Palm Oil (excluding kernels for crushing) for 1913 were as follows:—

Unrefined—British—	Cwts.	£
Sierra Leone ...	37,212 ...	54,057
Gold Coast ...	44,138 ...	61,597
Southern Nigeria ...	1,325,964 ...	1,931,707
Other British Possessions...	24,992 ...	37,570
Total ...	1,432,306	£2,084,931

Refined—Colonial and British Possessions—	Cwts.	£
British Possessions...	200 ...	432

Unrefined—Foreign—

	Cwts.		£
Germany	91,854	...	186,234
German West Africa	15,002	...	22,116
French West Africa	12,088	...	17,803
Portuguese W. Africa	4,101	...	5,765
Liberia	3,132	...	4,398
Other Foreign Countries	3,702	...	5,595
Total ...	129,879		£241,911

Refined—Foreign—

	Cwts.		£
Germany	55,848	...	135,820
Other Foreign Countries	2,182	...	5,715
Total ...	58,030		£141,535

The African Oil Palm (*Elaeis guineensis*) is fully dealt with in the *Kew Bulletin* for 1909, p. 33 and p. 161. Descriptions of various varieties are given in the same work for 1914, p. 285.

Central American Oil Palm, Cohune Palm (*Attalea Cohune*, Mart.).

British.—British Honduras.

This Palm is very common in British Honduras. The kernels are rich in oil, but the nuts are not largely worked owing to the thick woody pericarp being difficult to remove cheaply without injuring the kernels.

Olive (*Olea europaea*, L.).

British.—Australia. Foreign.—France, Spain, Italy, Greece, Turkey, Algeria, Tunis, California, etc.

The imports of Olive Oil to the United Kingdom are almost entirely from Foreign Countries. In 1911 and again in 1912 one tun of refined Olive Oil was imported from British Possessions. In 1911 the value was £81 and in 1912 £73. In 1913 British Possessions supplied this country with £33 worth of oil.

The imports of Olive Oil from Foreign Countries in 1913 were as follows:—

	Tuns.		Value. £
Netherlands	255	...	10,462
France	303	...	13,988
Spain	732	...	35,289
Italy	395	...	16,459
Greece	292	...	12,355
Turkey and Crete ...	693	...	33,252
Other Foreign Countries	212	...	8,386
Total ...	2,882		£130,191

It is probable that important Olive Oil industries could be developed in South Africa, New Zealand and British East Africa as well as in Australia.

Castor Oil (*Ricinus communis*, L.).

BRITISH.—India (chiefly). FOREIGN.—Italy, United States of America, &c.

In 1913, 1,203,355 cwts. of seed valued at £709,061 were imported into the United Kingdom from British India. From foreign sources 1584 cwts. valued at £992 were received. Although few countries are enumerated in the Board of Trade Returns as sending seed or oil to the United Kingdom, the plant is widely grown in tropical and sub-tropical countries, the oil expressed from the seeds being in considerable demand for lubricating purposes, burning, leather dressing, and for medicine. From Foreign Countries 1067 tons of oil valued at £32,174 were received in 1913, and from British India 332 tons of oil valued at £9,701 were imported during the same year.

Linseed (*Linum usitatissimum, L.*).

BRITISH.—India, Canada, &c. FOREIGN.—Russia, Germany, Netherlands, Belgium, France, Turkey (European and Asiatic), Morocco, China, United States of America, Uruguay, Argentine Republic, &c.

Large quantities of seed and oil are imported. In addition a considerable quantity of cake manufactured from the residue of the seed after most of the oil has been extracted is imported for cattle food. The imports of seed and oil for 1913 are as follows:—

Seed from Foreign Countries.

	Quarters.	Value. £
Russia	99,247	228,167
Germany	9,652	21,952
Netherlands ...	13,587	39,949
Belgium	5,325	12,326
France	57	196
Turkey, European ...	1,826	4,667
Turkey, Asiatic ...	872	2,347
Morocco	1,538	4,292
China (not Hong Kong nor leased territory)	7,709	17,957
U.S. America ...	42,936	98,366
Uruguay	3,036	7,165
Argentine Republic	1,126,866	2,398,635
Other Foreign Countries ...	377	967
Total ...	1,313,028	£2,836,986

Seed from British Possessions.

	Quarters.	Value. £
British India ...	682,948	1,564,428
Canada	1,277,673	2,792,955
Other British Possessions ...	413	1,030
Total ...	1,961,034	£4,358,413

Linseed Oil Imports for 1913.

FOREIGN—

Pure Oil.	Tons.	Value. £
Germany	1,074	29,340
Netherlands ...	3,045	82,578
Belgium	2,381	61,428
U.S. America ...	5,325	135,464
Other Foreign Countries ...	37	1,205
France	—	27
Total ...	11,862	£310,042

	Tons.	Value. £
BRITISH	4	115

Impure Oil.	Tons.	Value. £
Germany	3	105
Netherlands... ...	13	284
Belgium	5	102
Other Foreign Countries ...	1	22
Total ...	22	£513

Soya Beans (*Glycine hispida*, Maxim.).

FOREIGN.—Manchuria, China, Japan.

Large quantities of Soya Beans have been imported into the British Isles during the last 8 years, chiefly into Liverpool and Hull. They are almost entirely from Foreign Countries and the oil extracted from them is used for soap making.

Imports for 1913—

	Tons.	Value. £
Russia	38,086	316,848
China (not Hongkong or leased territories) ...	36,430	301,595
Japan, Formosa, &c.	1,929	17,240
Other Foreign Countries ...	2	21
Total ...	76,447	£635,704

Soya Beans imported from British Possessions in 1913.

Tons.	Value. £
5	43

It is likely that Soya Beans will prove to be a valuable crop in various British Colonies.

Cotton Seed (*Gossypium* spp.).

British.—India, Egypt,* Nigeria, Brit. East Africa, Uganda, West Indian Islands.

Foreign.—Turkey, U.S. America, Hayti, Brazil, Peru, &c.

The imports of Cotton Seed and Cotton Seed Oil for 1913 were as follows.

Cotton Seed from Foreign Countries.

	Tons.	Value. £
Russia	17,770	124,486
Germany	3,510	28,001
Portuguese Possessions in India ...	30,462	209,715
Turkey	26,639	171,877
Egypt	238,788	2,065,471
China (exclusive of Hongkong and leased territories)...	182	1,290
U.S. America ...	380	2,636
Hayti	1,860	14,138
San Domingo ...	132	967
Colombia	886	7,060
Peru	12,745	99,263
Brazil	47,629	326,369
Other Foreign Countries ...	3,234	21,439
Total ...	384,217	£3,072,712

* From 1915 Egypt appears under the heading British Possessions in the "Annual Statement of the Trade of the United Kingdom."

Cotton Seed from British Possessions.

	Tons.	Value. £
Southern Nigeria ...	5,360	32,002
British East Africa...	4,172	26,504
Uganda	5,142	39,305
British India ...	213,931	1,459,993
Other British Possessions	2,510	18,101
Total ...	231,115	£1,575,905

Cotton Seed Oil (unrefined) from Foreign Countries.

	Tons.	Value. £
China (exclusive of Hongkong and leased territories)...	654	18,163
U.S. America ...	405	13,331
Other Foreign Countries	2	50
Total ...	1,061	£31,544

Cotton Seed Oil (unrefined) from British Possessions.

	Tons.	Value. £
Total	9	204

Cotton Seed Oil (refined) from Foreign Countries.

	Tons.	Value. £
Netherlands ...	545	18,766
France	183	6,602
China (not Hongkong, &c.)	80	2,166
U.S. America ...	15,506	521,746
Other Foreign Countries	266	8,808
Total ...	16,580	£558,088

	Tons.	Value. £
From British Possessions	6	189

Rape Seed Oil (*Brassica campestris*, L. sub-sp. *Napus*, L.).

British.—India. Foreign.—Russia, Germany, Netherlands, Belgium, Japan, China.

Large quantities of seed for crushing and the extracted oil are imported annually. It is probable that a great deal more Rape seed could be produced in British Possessions.

Rape Seed imported from British India in 1913.

	Quarters.	Value. £
Total	96,497 ...	221,231

Rape Seed imported from Foreign Countries in 1913.

	Quarters.	Value. £
Russia	116,440 ...	194,617
Germany	3,430 ...	8,239
Netherlands ...	1,868 ...	7,311
Belgium	2,141 ...	5,369
Japan, Formosa, &c.	11 ...	30
China (exclusive of Hongkong, &c.).	32,880 ...	69,866
Other Foreign Countries	12,293 ...	25,062
Total ...	169,063	£310,494

Rape Seed Oil imported from Foreign Countries in 1913.

	Tons.	Value. £
Germany	1,539 ...	47,707
Netherlands ...	903 ...	29,118
Belgium	1,884 ...	55,411
France	366 ...	10,770
China (exclusive of Hongkong and leased territories)...	50 ...	1,500
Japan, Formosa, &c.	2,786 ...	75,791
Other Foreign Countries ...	71 ...	2,259
Total ...	7,599	£222,556

The residue of the seeds of Cotton, Rape, Soya Bean, Linseed and various other seeds is made into cake for cattle food and large quantities are imported in addition to the seeds and oil.

Ground Nuts (*Arachis hypogaea, L.*).

British.—West Coast of Africa, Rhodesia, Sudan, Natal, Ceylon, Fiji, West Indian Islands, &c.

Foreign.—Most tropical countries.

The imports are not given separately in the Board of Trade Returns, but a large quantity is imported from the various

British Colonies in Africa. It appears to be certain that all British needs could be supplied from the Colonies. The oil was worth from £38 to £45 a ton in 1911. The residue of the seed after the extraction of the oil can be used for cattle food and for manure.

Gingelly, Sesamum Seed, Sim Sim (*Sesamum indicum*, L.).

British.—India, Abyssinia, Sudan, Nigeria, &c. Foreign.—Asia Minor, &c.

The seed is very rich in oil which is used for soap making and as a substitute for Olive oil. In 1915 the price of seed per ton in Liverpool was £15 to £15 10s. The plant is easily grown in most tropical and sub-tropical countries. Full particulars of this species are given in *Kew Bull.* Add. Ser. ix. part 3, p. 511.

Sunflower Seed Oil (*Helianthus annuus*, L.).

British.—India. Also being tried in British East Africa, Sudan and other countries. Foreign.—Russia, China, &c. A sample of seed grown in the Sudan and examined at the Imperial Institute in 1911 was found to contain 22 per cent. of the whole seed of oil. The kernels alone contained 47·9 per cent. of oil. The residue of the seed after the oil has been extracted makes a good cattle food and the seeds are a good food for poultry. The seed received from the Sudan in 1911 was valued in Hull at £8 per ton. The seed was not, however, of the best quality. Col. Rep. Misc. Ser. No. 88, p. 467.

Manduro (*Balanites Maughamii*, Sprague.).

Foreign.—Portuguese East Africa. Lebombo Mountains and the banks of the Umbeluzi River.

The nuts contain about 60 per cent. of clear oil similar to Olive oil, burning with a bright flame. *Kew Bull.* 1913, p. 131. Col. Rep., Misc. Ser., No. 88, p. 492.

Balanites aegyptiaca, Delile.

British.—Northern Nigeria, Sudan, Uganda.

An oil resembling Cotton-seed oil has been obtained from the kernels which it is suggested (Col. Rep. Misc. Ser. No. 88, p. 492), could be used for soap-making and would probably be worth about the same as refined Cotton-seed oil. It is sometimes called "Betu Oil."

Osteophloeum platyspermum, Warb.

Foreign.—South America.

The kernels supply about 55 per cent. of fat. *Kew Bull.*, 1914, p. 333.

Oiticica Seed (*Moquilea* sp.).

Foreign.—South America.

Attention has frequently been directed to this seed in correspondence with Kew. The seeds are said to contain 64 per cent. of oil.

Mafura or Mafureira (*Trichilia emetica*, Vahl.).

British.—East Africa.

These seeds are said to contain 60 per cent. of a fatty oil used in cookery, for soaps and candles, &c. The value of the seeds in England may be £8-£9 a ton. *Kew Bull.*, Add. Ser. ix. pt. 1, p. 146.

Niger Seed Oil, Inga or Ramtil Seed Oil (*Guizotia abyssinica*, Cass.).

British.—Tropical Africa, cultivated in India.

The oil has been suggested as a substitute for Linseed oil in soap-making. It is used as a condiment and for burning. The seeds are also used as food for cage birds.

Okoto Nut or Koma Nut Oil (*Pentadesma butyracea*, Sabine).

British.—West Africa. Foreign.—Belgian Congo.

The kernels contain an edible oil. Several samples of the seeds have been received recently for identification.

See Bull. Agric. Congo Belge, 1912, vol. 3, No. 3, p. 573.

Chinese Wood Oil, Tung Oil (*Aleurites* spp.).

Foreign.—China.

This oil, which is a natural drying oil, has poisonous properties and is used in paints, varnishes, linoleum, &c. An article on "The Wood-oil Trees of China and Japan" is given in the *Kew Bull.*, 1914, p. 1.

Emi, Emi-Ori, Shea Butter (*Butyrospermum Parkii*, Kotschy).

British.—West Africa.

The kernels yield about 50 per cent. of fat known as Shea Butter. It is used for soap and candle making and in the manufacture of vegetable butters. See *Kew Bull.* Add. Ser. ix. pt. 3, p. 410.

In the above notes most of the principal fatty oils are mentioned together with a few of the more uncommon kinds to which attention has been directed lately. There are, however, a large number of other kinds of fatty oils derived from seeds, such as Dilo Seed Oil (*Calophyllum Inophyllum*, L.); *Vateria indica*, L., India; Poppy Seed Oil (*Papaver somniferum*, L.), Asia Minor, Persia, Egypt, India; Tea Seed Oil (*Camellia Thea*, Link.), India; Butter Tree of India (*Bassia butyracea*, Roxb.), India; *Mimusops Djave*, Engl., Southern Nigeria; Argan Oil (*Argania Sideroxylon*, R. & S.); Cow Pea Oil (*Vigna Catiang*, Walp.); *Pongamia glabra*, Vent.

References to many kinds of oil and fats are to be found in the Colonial Report (Miscellaneous Series) No. 88, and in *Kew Bull.* Add. Ser. ix. Some of the newer kinds of oil seeds are dealt with in *Kew Bull.*, 1913, p. 127, p. 131.

ESSENTIAL OILS.

Bergamot Oil (*Citrus Aurantium*, L., var. *Bergamia*).

British.—Jamaica. Foreign.—Italy, Germany, Algeria, &c.

In 1915 the average price of this oil, which is obtained from the rind of the green fruit, was about 12/6 per lb. Most of the imports are from Foreign Countries, but the West Indian Islands could probably produce a considerable quantity of oil for home use.

For further particulars see *K.B.* Add. Ser. ix. Part i. p. 123.

Oil of Orange (*Citrus Aurantium*, L.).

Foreign.—Sicily, South of France.

The price of this oil, obtained from the flowers, ranged, in 1915, from 6/3 to 7/6 a lb.

See *K.B.* Add. Ser. ix. Part i. p. 123 for further particulars.

Oil of Neroli (*Citrus Aurantium*, L.).

Foreign.—Germany, S. France, S. Spain.

This oil is obtained from the flowers of the Orange. The price varied in 1915 from 5/6 to 12/- per lb.

See *K.B.* Add. Ser. ix. Part i. p. 123.

Oil of Petitgrain (*Citrus Aurantium*, L., var. *Bigaradia*).

Foreign.—Paraguay, S. France.

This Oil is produced from the young twigs, leaves and immature fruit of the Bitter Orange. The best oil is said to be imported from Paraguay. Price in 1915 12/- to 13/- per lb.

In *K.B.* Add. Ser. ix. Part i. p. 124 other particulars are given.

Oil of Lemon (*Citrus medica*, L., var. *Limonum*).

Foreign.—Sicily, Germany, S. France.

The oil is obtained from the rind of the fruit. The principal country of production is Sicily. The price per lb. in 1915 ranged from 3/9 to 6/-.

See *K.B.* Add. Ser. ix. Part i. p. 136.

Oil of Limes (*Citrus medica*, L., var. *acida*, Brand).

British.—West Indian Islands, chiefly Jamaica, Dominica and Monserrat.

The price of this oil, obtained by distillation from Lime Juice, ranged in 1915 from 6/6 to 9/- per lb. A certian amount of oil in 1913 was imported from Germany.

See *K.B.* Add. Ser. ix. Part i. p. 132, for further particulars.

Oil of Japanese Star Anise (*Illicium verum*, Hook. f.).

Foreign.—China.

The oil is obtained from the fruits of this plant. They are often imported into France and the oil extracted there. Reference to this oil is given in *K.B.* 1888 p. 173.

Aniseed Oil (*Pimpinella Anisum*, L.).

Foreign.—Germany, South Russia, &c.

The oil is obtained from the fruits.

Oil of Cloves (*Eugenia caryophyllata*, Thunb.).

British.—Malay States, Mauritius, Zanzibar, West Indies, &c.

The oil is distilled from the unopened flower buds, from the leaves and from the wood. That from the buds was valued in 1915 at 5/4 per lb. and that from the leaves at 3/9 to 4/3 per lb.

Clove Bark Oil (*Dicypellium caryophyllatum*, Nees) and perhaps other trees.

British.—British Guiana. Foreign.—French Guiana.

Oil is distilled from bark and wood in S. America and wood is imported into France for the extraction of the oil. The oil has a strong clove-like odour. It is probable that the wood of other trees belonging to Lauraceae may be used for the same purpose. Particulars about this oil are given in *K.B.* 1912 p. 242.

Bitter Almond Oil (*Prunus Amygdalus*, var. *amara*, Stokes).

Foreign.—South of France.

The price of Almond Oil rose in 1915 from 12/6 per lb. to 36/- per lb. Oil obtained from the kernels of Apricot seeds imported from Asia Minor is said to be used as a substitute for Oil of Bitter Almonds.

Birch Oil (*Betula alba*, L., and other spp.).

Foreign.—Russia, Siberia, Germany, Austria, N. America.

The oil is obtained from the bark.

Cajuput Oil (*Melaleuca Leucadendron*, L., var. *minor*).

Foreign.—Celebes, Bouro, Amboyna.

The oil is distilled from the leaves and is used for medicinal purposes. Much of the oil used in this country has been imported through the Netherlands. Recent prices have been from 4/9 to 6/- per 21 ozs. Some oil is imported from the United States of America.

Oil of Bay (*Pimenta acris*, Kostel).

British.—W. Indies.

This oil, obtained by distillation from the dried leaves, is an industry of considerable importance in the West Indies. The leaves are also exported to other countries for the extraction of oil. *P. acris* var. *citrifolia* is a lemon-scented variety resembling very nearly *P. acris* proper, but differs markedly from it in the odour of the essential oil and does not appear to be extracted on a commercial scale. This variety is valueless as a source of True Bay oil.

See *K.B.* Add. Ser. ix. Part ii. p. 346.

Ajowan Oil (*Carum copticum*, Bth.).

British.—India, Egypt. Foreign.—Persia, Afghanistan, &c.

The oil has stimulative and carminative properties and is obtained from the fruits. It is rich in Thymol, and as most of the Indian exports of Ajowan seeds went to Germany before the war and Thymol was obtained from Germany that substance has become scarce. By the end of 1914 the price of seed had risen from 6/6 to 21/6 per lb. The following new sources of Thymol have been suggested. *Cunila mariana*, *Monarda punctata*, *Mosla japonica*, *Ocimum gratissimum*, *Ocimum viride*, *Origanum floribundum*, *Origanum hirtum*, *Satureia Thymbra*, *Thymus vulgaris*. See Bulletin of the Imperial Institute, Vol. xii. pp. 601-602. In *K.B.* 1916, p. 88 further information is given.

Caraway Oil (*Carum Carvi*, L.).

British.—British Isles, India. Foreign.—Holland, Germany, Russia, &c.

The oil, obtained from the fruits, has been scarce during the last year or two, and prices have advanced from 6/- per lb. in January, 1915, to 9/- per lb. in December, 1915. The cultivation of this plant might be increased in the British Isles.

Ylang-Ylang Oil and Cananga Oil (*Cananga odorata*, Hk. f. & Thoms.).

Foreign.—Luzon, Java, Bourbon and Madagascar.

Ylang-Ylang Oil is obtained by distillation from the fresh flowers of *Cananga odorata* and Cananga Oil from dried flowers of the same tree. Much of the trade seems to have been conducted through Germany. As the tree is common in the Malay Peninsula the extraction of the oil might be carried on in British Colonies. The price of the oil is at present about 10/- per lb.

See *K.B.* 1906, p. 398, for further particulars.

Camphor Oil (*Cinnamomum Camphora*, Nees).

British.—Ceylon. Foreign.—Formosa, China, Japan.

To distinguish this oil from other Camphor Oils it is often called Common or Laurel Camphor Oil. The oil is usually distilled from the wood, but sometimes from the leaves. It may be noted that for some years past the Camphor tree has been experimentally cultivated in many of our Colonies with varying results, for, although the trees have thriven, in many instances they have failed to yield Camphor and only "light" Camphor oils in small quantities. The evidence is apparently conclusive that from the botanical characters alone it is impossible to distinguish the difference between oil-yielding and non-oil-yielding trees.

In *K.B.* 1899, p. 57, and 1908, p. 88, other particulars are given.

Borneo Camphor Oil, Sumatra Camphor Oil (*Dryobalanops aromatica*, Gaertn.).

British.—Malay States.

Cinnamon Oil (*Cinnamomum zeylanicum*, Breyn).

British.—Ceylon.

Oil can be obtained from both the leaves and the bark. At the present time it is valued at 5d. to 6d. per lb.

Citronella Oil (*Andropogon Nardus*, L.).

British.—Ceylon, Singapore. Foreign.—Java.

The oil is obtained from the leaves. Ceylon oil was valued at from 1/6 to 1/7 per lb. in the autumn of 1915 and Java oil was worth from 3/- to 3/6 per lb. at the same time. For further particulars see *K.B.* 1906, p. 297.

Eucalyptus Oils (*Eucalyptus* spp.).

British.—Australia.

The oil is distilled from the fresh leaves. Although native of Australia the various species of *Eucalyptus* are cultivated in many countries, and the distillation of the oil is undertaken in California, S. Europe, India, Transvaal, &c. Of the numerous species used three of the most important are *E. Globulus*, Lab. (Blue Gum); *E. citriodora*, Hook. (Lemon-scented Gum); *E. amygdalina*, Lab. (Peppermint Tree). In the autumn of 1915 the oil of *E. Globulus* was valued at 1/9 to 2/- per lb. That of *E. amygdalina* was worth 1/- to 1/2 per lb., and oil of *E. citriodora* sold at 7/6 per lb. There might be a good future for the distillation of oil from various species of *Eucalyptus* in South Africa. For other information see *K.B.* Add Ser. ix. Part ii. p. 312.

Oil of Geranium (*Pelargonium* spp.).

Foreign.—France, Spain, Algeria, Germany.

This oil is obtained from the leaves of several South African species of Pelargonium, chiefly *P. Radula*, var. *odoratissimum*, Soland., and *P. capitatum*, Ait., cultivated for the purpose in S. France, Spain, Algeria and the Island of Réunion. The value of the oil in 1915 was Bourbon, 9/6 to 10/3 per lb.; Algerian, 12/- to 15/- per lb.; French, 30/- to 35/- per lb.

Ginger-grass Oil (*Andropogon Schoenanthus*, L.).

British.—India.

The oil, which is extracted from the leaves, was valued in 1915 at from 5/6 to 6/- per lb.

Further information is given in *K.B.* 1906, p. 297.

Lavender Oil (*Lavandula vera*, DC.).

British.—England. Foreign.—South of France.

The cultivation of Lavender for oil is undertaken in certain parts of Surrey, Hertfordshire and a few other places in England, but the business appears to be capable of development. English oil was worth from 58/- to 60/- per lb. in 1915, and French oil at the same time sold at 11/6 to 16/6 per lb.

Oil of Spike or Lavender Spike Oil (*Lavandula Spica*, Cav.).

FOREIGN.—Spain, S. France.

This oil is inferior in quality to ordinary Lavender oil, and realised from 2/6 to 4/6 per lb. in 1915.

Otto of Rose (*Rosa* spp.).

FOREIGN.—Bulgaria, S. France, Persia, &c.

The chief Rose grown for the production of oil is *Rosa damascena*, Miller, others being *R. gallica*, L., *R. centifolia*, L., and *R. moschata*, Hermm. The oil is obtained from the petals of newly-expanded flowers collected before sunrise. In the autumn of 1915 it was worth from 42/- to 45/- an English ounce. For other information see *K.B.* 1893, p. 22.

Patchouly Oil (*Pogostemon Cablin*, Bth.).

BRITISH.—India.

The oil is obtained from the leaves. Its value in 1915 was 20/- to 22/- per lb. For full particulars see *K.B.* Add. Ser. ix. Part iii. p. 534. *K.B.* 1908, p. 78.

Oil of Peppermint (*Mentha piperita*, L., and var. *officinalis*).

BRITISH.—British Isles. FOREIGN.—Japan, France, Germany, United States of America.

Peppermint is grown in several parts of England, but there appears to be room for an extension of its cultivation. The highest price obtained for the oil in 1915 was 14/6 per lb., the lowest price for American oil was 6/9 per lb. *Mentha arvensis*, L., is the source of Japanese Peppermint Oil.

Pine Oil (*Pinus* spp.).

FOREIGN.—Siberia, Bavaria, Switzerland, &c.

A somewhat similar oil is obtained from the leaves and young shoots of species of Abies, Larix and Picea. The oil was valued in 1915 at 1/6 to 4/6 per lb.

Sandalwood Oil (*Santalum album*, L.).

BRITISH.—Mysore.

Price in January, 1915, 22/- to 23/- per lb., price in December, 1915, 30/- to 32/- per lb.

Turpentine (*Pinus* spp.).

FOREIGN.—France, Germany, United States of America.

A great deal of turpentine is obtained from *Pinus Pinaster* in Western France, the chief port of shipment being Bordeaux. Turpentine is also obtained from *P. sylvestris* in various European countries, from *P. australis* (*P. palustris*) in the South-Eastern United States, and from *P. excelsa* and *P. longifolia* in the Himalaya. Venetian Turpentine is obtained from *Larix europaea*.

There are many more essential oils; some orders of plants, particularly *Labiatae*, *Lauraceae*, *Compositae* and *Umbelliferae*, being very rich in them, but the more important ones are mentioned in the above list.

GUMS, GUM RESINS AND RESINS.

Gum Arabic (*Acacia arabica*, Willd. and *Acacia Senegal*, Willd.).

British.—India, Egypt, Anglo-Egyptian Sudan, Nigeria, &c. Foreign.—Morocco, Senegal, &c.

The total amount of gum-arabic imported into the United Kingdom from all sources was, in 1913, 113,274 cwts., value £229,791, and in 1915 150,282 cwts., value £255,092.

Acacia Senegal is a tree native of Senegal, widely distributed in Tropical Africa and cultivated in India. In Kordofan the gum is obtained from both wild and cultivated trees, and the Arabic name of the best quality there is "Hashab." This tree yields the true gum-arabic of commerce usually known as "Kordofan," "Picked Turkey," "White Senaaf" or "Senegal Gum," graded according to colour, size and general appearance.

Acacia arabica is a tree widely distributed in Tropical Africa, India, &c. It yields a large proportion of the gum-arabic of commerce, chiefly "Morocco," "Mogador" or "Brown Barbary" and "East Indian" (so-called because it comes into commerce from Aden and the Red Sea ports via Bombay).

An inferior sort known as "Suakim" or "Talki" gum is obtained from *Acacia Seyal*, Delile, one of the principal Acacias yielding gum in the Nile region.

The inferior quality sometimes complained of in certain supplies of gum-arabic may be due to a mixture of inferior sorts or inefficient grading. Variation in quality is also sometimes attributed to climate, soil, seasons, &c.

The most important centres of the trade in gum-arabic are Senegal and Kordofan, and the principal markets are (or have been) Antwerp, Barcelona, Bordeaux, Hamburg, Havre, Liverpool, London, Marseilles, Melbourne, New York and Trieste. Confectioners are probably the largest users.

Further particulars regarding gum-arabic and allied gums are to be found in *K.B.* Add. Ser. ix. Part ii. p. 288, and in *K.B.*, 1910, p. 133.

Gum Tragacanth (*Astragalus gummifer*, Lab.; *A. eriostylus*, Boiss. and Haussk.; *A. adscendens*, Boiss. and Haussk.; *A. brachycalyx*, Fisch.; *A. microcephalus*, Willd., and other species).

Foreign.—Spiny shrubs native of mountainous districts in Asia Minor, Persia, Syria and Greece. Smyrna and Basra are important trade centres in the countries of production, and the principal markets in Europe are London, Marseilles, Trieste, &c. See also *K.B.*, 1895, p. 238.

Asafoetida (*Ferula Narthex*, Boiss., and *F. foetida*, Regel).

F. Narthex or "Tibetan Asafoetida" is a native of the northern slopes of the mountains dividing Kashmir from Western Tibet. *F. foetida* grows on the East of the Sea of Aral and also in Northern Afghanistan, and furnishes "Persian Asafoetida."

Gum Ammoniacum (*Dorema Ammoniacum*, Don).

Northern Afghanistan, South-West and Northern Persia, and known in the trade as "Persian Ammoniacum."

Particulars of other Gums Ammoniac are given in *K.B.*, 1907, p. 375.

Myrrh (*Commiphora* spp.).

Somaliland, Southern Arabia.

Myrrh is usually shipped from Aden to Europe or Bombay.

Myrrh is dealt with in *K.B.*, 1897, p. 98.

Bdellium (*Commiphora* spp.).

India, Africa.

"Indian Bdellium" (*Commiphora Mukul*, Engl.) is a tree found in the dry parts of Sind, Kathiawar, &c. "African Bdellium" (*Commiphora africanum*, Engl.) is exported to Bombay from Berbera.

Rosin or Common Resin (*Pinus* spp.).

British.—India, &c. Foreign.—Belgium, France, Portugal, Spain, United States of America.

The amount of Rosin imported into the United Kingdom from all sources was in 1913 1,758,067 cwts., value £1,120,652, and in 1915 2,048,264 cwts., value £1,191,483.

Rosin is the residue after distillation of Oil of Turpentine. Indian Turpentine is obtained from *Pinus longifolia*, Roxb., American Turpentine from "Pitch Pine" (*Pinus palustris*, Mill.), and European Turpentine from "Scotch Pine" (*Pinus sylvestris*, L.). "Corsican Pine" (*P. Laricio*, Poir.) and "Cluster Pine" (*P. Pinaster*), of the Mediterranean region, yield the "Bordeaux Turpentine" of commerce.

Kauri or "Gum" Kauri (*Agathis australis*, Salisb.).

British.—New Zealand, from whence this country imported, in 1913, 145,633 cwts, value £602,851, and in 1915 64,692 cwts., value £293,263.

Lac (*Tachardia lacca*, Kerr), an insect belonging to the *Coccideae*).

British.—India, Straits Settlements. Foreign.—French Indo-China, Siam.

The lac insect lives upon various plants, principally *Butea frondosa*, Roxb., *Ficus religiosa*, L., *Schleichera trijuga*, Willd.,

Shorea robusta, Gaertn., *Zizyphus Jujuba*, Lam., &c., and in some parts plants are grown specially for feeding this insect as *Acacia arabica*, Willd., in Sind, and *Cajanus indicus*, Spreng., in Assam, &c.

Lac yields a dye and a resin; the chief source of the Lac-dye, Seedlac, Shellac and Sticklac of commerce is British India, from whence, in 1913, this country imported 107,015 cwts., value £411,761, the total from all sources for the same year being 108,739 cwts., value £418,447. In 1915 the total from all sources imported into the United Kingdom was 113,470 cwts., value £355,122.

Amongst other resins more or less of commercial importance may be mentioned "Gum Accroides" or "Grass Tree Gum" obtained from *Xanthorrhoea hastilis*. R. Br., *X. arborea*, R. Br., *X. Preissii*, Endl., *X. australis*, R. Br., &c., natives of Australia; "Guaiacum" obtained from the stem of *Guaiacum officinale*, L., a tree native of Tropical America, and *G. sanctum*, L., native of Southern Florida, Bahamas, Cuba, &c.; "Mastic" (*Pistacia Lentiscus*, L.) from the Greek Archipelago, chiefly in Scio; "Elemi" or "Gum Elemi" (or Soft Resin) from *Canarium luzonicum*, A. Gray, native of the Philippine Islands; "Benzoin" or "Gum Benjamin" or "Sumatra Benzoin" (*Styrax Benzoin*, Dryand.), from Sumatra and "Siam Benzoin" (*Styrax* sp.) from Siam; "Piney Resin," "Indian Copal" or "White Dammar" (*Vateria indica*, L.), native of Southern India; "Dammar" (*Agathis loranthifolia*, Salisb.), a Conifer, native of Burma and the Malay Peninsula; "Copal" "Anime" or "Zanzibar Copal" (*Trachylobium Hornemannianum*, Heyne), native of Zanzibar; a similar product is obtained from the "West Indian Locust Tree" (*Hymenaea Courbaril*, L.), from British Guiana; "Inhambane Copal" (*Copaifera Gorskiana*, Benth.), from Mozambique; "Sierra Leone Copal" (*Copaifera Guibourtiana*, Benth.); "Accra Copal" (*Copaifera* sp.) from the Gold Coast and "Ogea" (*Daniellia Ogea*, Rolfe, and probably other species) from Lagos and Southern Nigeria, &c.

The following Gums and Resinous Substances have been discussed in the *Kew Bulletin*:—

"Bengal Kino Tree (*Butea frondosa*)," Sept., 1887, p. 20, and "*Butea frondosa*," Add. Series ix. Part ii., p. 222.

"Brazilian Gum Arabic," 1888, p. 128: correspondence between the Royal Gardens, Kew, and the British Consulate, Para; on "Jatuba" (*Hymenaea* sp.) and "Angico" (*Acacia Angico;* determined later on specimens received at Kew as *Piptadenia macrocarpa*).

"Inhambane Copal (*Copiafera Gorskiana*)," 1888, p. 281.

"Dammar from New Caledonia," 1891, p. 76.

"Siam Products," 1892, p. 312; specimens sent to Kew by Mr. W. R. D. Beckett, of H.M. Legation, Bangkok; probably *Shorea robusta*; reported on for Kew by Mr. R. Ingham Clark, West Ham Abbey, Stratford, London, E.

"Gum Tragacanth," 1894, p. 36; Extract from Foreign Office Report on the Trade of Baghdad and Bussorah, No. 1320, 1894 and 1895, pp. 238–239.

"Siam Benzoin," 1895, p. 154 and p. 195; "The Source of Siam Benzoin (*Styrax benzoides*)," 1912, p. 391.

"Siam Gamboge (*Garcinia Hanburyi*)," 1895, p. 139.

"Myrrh and Bdellium," 1896, p. 86, including "Arabian Myrrh," "African Bdellium," "Opaque Bdellium," "Bissa Bôl, Hotai," and "Indian Bdellium," "Myrrh," 1897, p. 98. "*Commiphora africanum*," Additional Series ix. Part i., p. 140.

"Kino from *Myristica malabarica*," 1897, p. 101.

"Incense Trees of the West Indies," 1898, p. 239, including *Bursera gummifera*, the "Birch Tree" of Jamaica, the "Gommier" of the Windward and Leeward Islands, and the "Turpentine Tree" of St. Vincent; *Dacryodes hexandra*, the "Mountain Incense Tree" or "Gommier" of Dominica; and *Protium guianense*, indigenous to the mainland of South America.

"*Trachylobium Dewevrianum*," 1899, p. 139, a newly-discovered Copal from the Congo; sample reported upon, for Kew, by Messrs. Ingham Clark & Co., West Ham Abbey, Stratford, valued at about £40 per ton.

"East Indian Dragon's Blood (*Daemonorops* spp.)," 1906, p. 197, Malay Penisula, Sumatra and Borneo.

"Persian Gum (*Amygdalus leiocarpa*)," 1906, p. 109.

"Ogea Gum (*Daniella* and *Cyanothyrsus*)," 1906, p. 199; "*Daniellia*," Add. Series ix. Part ii., p. 268; "*Paradaniellia Oliveri*," Add. Ser. ix. Part 2, p. 270; 1912, p. 96.

"The Gums Ammoniac of Morocco and the Cyrenaica (*Ferula communis*, var. *brevifolia*)," 1907, p. 375.

"Sudan Gum," 1907, p. 23.

"African Kino (*Pterocarpus erinaceus*)," Add. Series ix. Part 2, p. 239-240.

"Gum Arabic (*Acacia* spp.)," Add. Series ix. Part ii., p. 288, including *Acacia arabica*, *A. Senegal*, &c.

Various Gums and Resins are dealt with in Colonial Report, Misc. Series, No. 63, 1909, "Selected Reports from the Scientific and Technical Department, Imperial Institute," pp. 1-202.

Reference might also be made to "A Few Notes on Varnish and Fossil Resins," by R. Ingham Clark, pp. 1-69, in which is acknowledged, to the Royal Gardens, Kew, "such information on the subject as the Gardens afford."

The imports with the corresponding values, given under "Gum Arabic," "Rosin," "Kauri," and "Lac," are taken from "The Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions," Vol. i., 1915, and "Accounts Relating to Trade and Navigation of the United Kingdom, Dec., 1915," and as with Dyes and Tanning

Materials, figures are not readily separated from the returns given in reference to some of the products mentioned in the above notes; the "Unenumerated" Gums from Foreign Countries amounting for instance in 1913 to 162,065 cwts. value £392,588 and from British Possessions in the same year, including Sierra Leone, Gold Coast, Zanzibar, Aden, British India, Straits Settlements, Australia, &c., to 67,535 cwts., value £135,498.

RUBBER, GUTTA-PERCHA AND BALATA.

Para Rubber (*Hevea brasiliensis*, Muell. Arg.).

British.—Ceylon, Straits Settlements, Federated Malay States. Foreign.—Brazil-Amazon Region, Dutch East Indies.

Under cultivation in West Africa—Sierra Leone, Gold Coast, Togoland, Nigeria, &c., in Trinidad, Dominica, Mauritius, Seychelles, East Africa, Zanzibar, &c.

Plants or seeds were distributed to the various Colonies from the Royal Botanic Gardens, Kew, beginning about 1873. The returns of rubber imported into the United Kingdom show that plantation rubber from British Possessions in the East now exceeds that from wild trees in Brazil, the original home of the plant. The imports in 1915 were, from the Straits Settlements 660,532 centals (of 100 lb.) value £7,384,830; Federated Malay States, 288,803 centals, value £3,340,071; and from Ceylon, 286,097 centals, value £3,230,218, or a total from these Possessions of 123,543,200 lb., value £13,955,119, against 28,639,100 lb., value £3,240,779 from Brazil. See also *K.B.*, 1907, p. 153; 1908, p. 379; 1914, p. 162; 1917, p. 118.

Ceara Rubber (*Manihot Glaziovii*, Muell. Arg.).

Foreign.—Brazil, German East Africa.

Cultivated in India and the Colonies mentioned under *Hevea*. "Jequie Manicobas" (*Manihot* spp.) natives of Brazil, and recently introduced to many British Colonies, are fully discussed in *K.B.* 1908, p. 59, and 1910, p. 204.

Assam Rubber (*Ficus elastica*, Roxb.).

British.—Assam, Burma, Federated Malay States. Foreign. —Java, Sumatra.

Distributed by cultivation to the Colonies mentioned above.

Lagos, Silk or West African Tree Rubber (*Funtumia elastica*, Stapf).

Foreign.—French West Africa, Cameroons, Liberia, &c.

Cultivated on a large scale in most of the West African Colonies and Uganda, in the Cameroons, Congo, &c., and distributed to Trinidad, Straits Settlements, and other Tropical Countries out of Africa by seeds or plants from the Royal Botanic Gardens, Kew, beginning about 1896. For references see *K.B.*, 1905, p. 56; 1907, p. 187; 1909, p. 147; 1910, p. 206; 1911, p. 125. Add. Ser. ix. Part iii., p. 451.

African Vine Rubber (*Landolphia* spp.).

British and Foreign Tropical Africa. Believed to come exclusively from wild vines but under experimental cultivation in West Africa and other Colonies. See *K.B.* Add. Ser. ix. Part iii., p. 428.

Borneo Rubber (*Willughbeia* spp. and *Leuconotis* spp.).

Borneo and Malaya.

Central American Rubber (*Castilloa elastica*, Cerv.).

British.—British Honduras. Foreign.—Nicaragua, Guatemala, Mexico, Ecuador.

Cultivated with success in Trinidad, and under experimental cultivation in most of the British Colonies in the Tropics, having been distributed from Kew, beginning about 1875, to Ceylon, Singapore, Fiji, Mauritius, West Africa, West Indies, &c.; also to Java. See *K.B.*, 1899, p. 159.

Mangabeira Rubber (*Hancornia speciosa*, Gomez).

Foreign.—Brazil, chiefly shipped from Pernambuco and sometimes called "Pernambuco Rubber." *K.B.*, 1892, p. 67; 1899, p. 185.

Abba Rubber (*Ficus Vogelii*).

British.—West Africa; sometimes called "Lagos Rubber." For particulars see *K.B.*, 1888, p. 253; 1890, p. 89.

Touckpong and Colombian Virgen Rubber (*Sapium* spp.).

British.—Guiana.—Foreign.—Colombia, Bolivia, &c. Sometimes also called "Bolivian," "Colombian," or "Esmeralda" "Scrap Rubber."

Guayule (*Parthenium argentatum*, A. Gray).

Foreign.—Mexico. *K.B.*, 1907, p. 285; 1908, p. 255; 1910, p. 211.

Colorado Rubber (*Hymenoxys* sp.).

Foreign.—Colorado.

Both of these plants are wild, yielding an inferior description of rubber, and are exceptional as belonging to *Compositae*, an Order not usually associated with the product obtained from trees with a milky juice.—*Apocynaceae*, *Euphorbiaceae*, &c.

The foregoing are the principal rubbers of Commerce, and the imports into this country are usually entered according to country of origin without reference to botanical source.

The countries of production include under British Possessions: Gambia, Sierra Leone, Gold Coast, Nigeria, Natal, East Africa Protectorate, Zanzibar and Pemba, India, Straits Settlements, Federated Malay States, Ceylon and Dependencies, Borneo, &c. (from whence, in 1913, came 776,790 centals, value

£11,739,834). Under Foreign Countries: Dutch East Indies, Dutch Guiana, German West and East Africa, French West Africa, Somaliland, Madagascar, Portuguese West and East Africa, Congo, Liberia, Mexico, Colombia, Venezuela, Ecuador, Peru, Chile, Brazil, Uruguay, Bolivia, Argentine Republic, &c. (from whence, in 1913, came 797,649 centals, value £8,784,185).

The total amount from all sources in 1913 is therefore 1,574,439 centals, value £20,524,019; and in 1915 1,825,659 centals, value £20,225,060 were imported, the figures for this year showing that the British Possessions supply the greater quantity of rubber to the Home country.

Gutta-Percha (*Palaquium Gutta*, Burck., &c.).

British.—Malaya. Foreign.—Java, Sumatra.

Native of Malaya; cultivated in the Straits Settlements and Java. Distributed to many British Colonies in the Tropics from Kew.

Pontianak Gutta (*Dyera costulata*, Hook.f.), from Malaya and Borneo.

Balata (*Mimusops bidentata*, DC.).

British.—Guiana. Foreign.—Venezuela, Dutch Guiana.

This is the chief forest product of British Guiana. The latex is sometimes adulterated with that of "Touckpong" Rubber (*Sapium Jenmani*), and the imports appear to be entered as "Gutta-Percha," the total from all sources being given in 1915 as 75,894 cwt., value £668,431. In 1913, 111,240 cwt., value £1,370,658, were imported into the United Kingdom.

Further particulars of all the above rubbers are given in *Kew Bulletin*, Additional Series vii., "Rubber," 1906, or in subsequent issues of the *Bulletin*. See also Colonial Reports, Miscellaneous, No. 82, 1912, "Selected Reports from the Scientific and Technical Dept. Imp. Institute: "Rubber and Gutta-Percha," pp. 1-447: Rubber Cultivation in Togoland and German East Africa, *K.B.*, 1911, p. 97.

The following have been discussed in the *Kew Bulletin*:—

"New Rubber-Containing Plants," 1908, p. 199.

"A New Rubber Plant (*Asclepias stellifera*)", 1909, p. 345, from the Transvaal, sample from the root valued by Messrs. Hecht, Levis & Kahn for Kew (14. iv. 09) at about 4/6 per lb.

"Ecanda Rubber (*Raphionacme utilis*)," 1908, p. 209; p. 305. Tubers from Benguela and details of tubers sent to Kew by the Companhia de Moçambique, examined in the Jodrell Laboratory at Kew.

"A New Rubber Tree: Palo Amarillo (*Euphorbia fulva*)," 1907, p. 294, and 1909, p. 392.

"Nandi Rubber (*Landolphia ugandensis*)," 1910, p. 304, a first-rate rubber from Uganda, the vine found growing at an altitude of 4000 ft.

"Rubber Cultivation in Togoland and German East Africa," 1911, p. 97.

"The Introduction of Para Rubber to Buitenzorg," 1914, p. 162.

"Wild Rubber & Selection, 1915, p. 183.

"Rediscovery of Gutta Percha Tree at Singapore," 1891, p. 230; "New Process for recovering loss," p. 231.

"Indian Gutta Percha," 1892, p. 296.

"Extraction of Gutta Percha from leaves," 1897, p. 200.

"Gutta Percha Trees of the Malay Peninsula," 1907, p. 109. "Palaquium," Add. Ser. ix., pt. iii. p. 403.

"Balata," 1911, p. 198. Add. Ser. ix. Part iii. 415.

DRUGS.

Aconite (*Aconitum Napellus*, L.).

British.—British Isles (Cultivated). Foreign.—Swiss Alps, Salzburg, North Tyrol, Vorarlberg.

A good deal of Aconite root has been obtained from Switzerland and Germany; the cultivation of the plant might be extended in the British Isles. Japanese Aconite Root is from *A. Fischeri*, and probably other species. Dried root from foreign sources other than Japan is usually worth about 50/- per cwt., Japanese root at the same time sells for about 35/- per cwt., and English root for about 2/- per lb.

Aloes (*Aloe* spp.). Inspissated juice from the leaves.

British.—South and East Africa, particularly Zanzibar, India, West Indies. Foreign.—Curacao.

In February, 1916, Zanzibar Aloes were valued at 75/- to 87/6 per cwt. and Curacao Aloes at 72/6 to 87/6 per cwt. Cape Aloes sold for 39/- per cwt.

Dill Fruits (*Peucedanum graveolens*, Bth. and Hk. f.).

British.—British Isles. Foreign.—Netherlands and various parts of Central and Southern Europe.

It is probable that the cultivation of Dill could be extended profitably in the British Isles. The plant is also grown in India.

Chamomile Flowers (*Anthemis nobilis*, L.).

British.—British Isles. Foreign.—Hungary, Italy, Germany, Belgium.

More Chamomile Flowers might be produced in the British Isles. The present price of the flowers is from 115/- to 140/- per cwt., according to quality.

Horseradish Root (*Cochlearia Armoracia*, L.).

FOREIGN.—Belgium, France, Germany, Holland.

A large quantity of Horseradish Root is imported for use in medicine and as a condiment. It is probable that the whole of the wants of the British Isles could be supplied from home-grown plants. At the present time very little is grown here from a commercial point of view, although a small plot is found in most kitchen gardens.

Asafoetida (*Ferula Narthex*, Boiss., and *F. foetida*, Regel, &c.).

FOREIGN.—Mountains of Persia and Afghanistan.

A gum-resin obtained from the roots.

Belladonna (*Atropa Belladonna*, L.).

BRITISH.—British Isles. FOREIGN.—Germany, Austria, &c.

The country might easily be self supporting in this drug. In 1913 the price of dried leaves was from 38/- to 60/- per cwt. It is now 200/- to 300/- per cwt. The roots are also employed medicinally.

Balsam of Peru (*Myroxylon Pereirae*, Klotzsch.).

FOREIGN.—State of Salvador, Cent. America.

The balsam exudes from the trunk after it has been beaten and scorched. Value in February, 1916, 21/- to 21/6 per lb.

Balsam of Tolu (*Myroxylon Toluifera*, H.B. and K.).

FOREIGN.—Colombia and Venezuela.

This and the last named might perhaps be produced in the West Indies or in British Guiana.

Bael Fruit (*Aegle Marmelos*, Corr.).

BRITISH.—India.

The drug is manufactured from the unripe fruit. There does not appear to be room for much development in the production outside India. It is occasionally imported.

Buchu (*Barosma* spp. particularly *B. betulina*, Bart.).

BRITISH.—South Africa.

It is doubtful whether the cultivation of Buchu could be conducted satisfactorily outside S. Africa. The forestry officials in S. Africa now exercise supervision over the collection of Buchu leaves. Between Jan. 1st, 1915, and Nov. 30th, 1915, 142,495 lbs. of Buchu leaves, valued at £26,575, were imported into the British Isles.

Calumba Root (*Jatorhiza Columba*, Miers).

FOREIGN.—Portuguese East Africa, &c.

Camphor (*Cinnamomum Camphora*, Nees.).

British.—Ceylon (cultivated). Foreign.—Formosa, Japan, China.

In February, 1916, crude Camphor was valued at 165/- a cwt. and refined Camphor at 1/7 per lb. for 2½ lb. slabs. Particulars of the distillation of Camphor are given in *K.B.*, 1907, p. 88.

Caraway Seeds (*Carum Carvi*, L.).

British.—British Isles, India. Foreign.—Holland.

This crop might be grown more extensively in the British Isles. The "Perfumery and Essential Oil Record" for February, 1916, pp. 32-33 and p. 38, directs attention to the extensive area of land usually employed for the cultivation of this plant which has been devastated by the recent floods in Holland. The price of Caraway Seed in Feb., 1916, was from 56/6 to 57/6 per cwt.

Indian Hemp (*Cannabis sativa*, L.).

British.—India. Foreign.—Russia, Temperate Asia.

Cloves (*Eugenia caryophyllata*, Thunb.).

Malay States, Mauritius, Zanzibar, West Indies, &c.

Cloves of commerce are the unopened flower-buds of *Eugenia caryophyllata*. The present price is about 7d. per lb. wholesale.

Cascara Sagrada (*Rhamnus Purshiana*, DC.).

Foreign.—Western N. America, particularly California.

It is probable that this bush might be grown profitably in the milder parts of the British Isles. Bark from English-grown plants has been manufactured and found to be equal in merit to American-grown bark. Dried bark was valued at 52/6 per cwt. in February, 1916.

Cinchona Bark (*Cinchona* spp., particularly *C. Calisaya*, Wedd., *C. Ledgeriana*, Moens, and *C. succirubra*, Pav.).

British.—India, Jamaica. Foreign.—Peru, Ecuador, Java.

Quill and broken quill bark was sold at 7½d. to 9½d. per lb. in February, 1916. For particulars of Cinchona see *K.B.*, 1888. p. 139; 1890, pp. 29 and 54; 1894, p. 327.

Cocaine, Coca (*Erythroxylon Coca*, Lawk.). The leaves.

Foreign.—Peru.

The plant is also cultivated in Ceylon. Cocaine is worth about 21/- per oz., less 5 per cent. for hydrochloride, at the present time.

Colchicum Corm (*Colchicum autumnale*, L.).

British.—British Isles. Foreign.—Central and Southern Europe, N. Africa.

Both corms and seeds are used. It is possible that a greater quantity could be produced in the British Isles.

Senna Leaves, Alexandrian Senna (*Cassia acutifolia*, Delile), **Tinnevelly Senna** (*C. angustifolia*, Vahl.).

Egypt, Arabia.

Other species of *Cassia* also have medicinal properties, including *C. Fistula*, L., *C. marylandica*, L., and *C. obovata*, Collad. Pods and flowers are used as well as the leaves in some cases. Senna leaves are worth up to 10½d. per lb.

Colocynth (*Citrullus Colocynthis*, Schrad.).

Foreign.—Smyrna, Trieste, France, Spain.

The fruit pulp.

Coriander (*Coriandrum sativum*, L.).

British.—British Isles (Essex). Foreign.—Russia, Germany, Holland, Morocco.

The fruits are at present valued from 17/3 to 19/- per cwt. It would probably pay to produce more fruits in the British Isles.

Datura Leaves and Seeds (*Datura fastuosa*, L., var. *alba*, *D. Stramonium*, L., and *D. Metel*, L.).

British.—British Isles. Foreign.—Germany, Austria.

It is probable that the British Isles could be made self-supporting with regard to this drug.

Digitalis, Foxglove (*Digitalis purpurea*, L.). The leaves.

British.—British Isles, wild and cultivated. Foreign.—Germany, Austria, &c.

A greater quantity could be produced in the British Isles.

Fennel Seed (*Foeniculum vulgare*, Mill.).

Foreign.—France, Austria, Persia, Japan, &c.

Seed is sometimes grown in the British Isles. Value February, 1916, 31/- to 32/- per cwt.

Gentian Root (*Gentiana lutea*, L.).

Foreign.—France, Germany, Switzerland, &c.

Price in February, 1916, whole root 62/6 to 65/- per cwt., cut root 72/6 per cwt.

Liquorice Root (*Glycyrrhiza glabra*, L.).

British.—British Isles (Yorkshire, near Pontefract). Foreign.—Belgium, Germany, Russia, Asia Minor, Persia, France, Spain, &c.

This crop was formerly grown more extensively than at present in the British Isles. Present price about 40/- per cwt.

Witch Hazel Bark (*Hamamelis virginica*, L.).

Foreign.—North America. This could probably be produced both in the British Isles and Canada.

Golden Seal or Hydrastis Rhizome (*Hydrastis canadensis*, L.).

North America.

This plant is sometimes grown for commercial purposes in the British Isles, but its cultivation might be extended.

Henbane (*Hyoscyamus niger*, L.).

BRITISH.—British Isles. FOREIGN.—Germany, Russia, Austria.

The leaves are the important part of the plant. English-grown leaves after drying are usually worth from 3/- to 6/- per lb. More might be grown in the British Isles.

Ipecacuanha Root (*Psychotria Ipecacuanha*, Stokes).

BRITISH.—India, Malay States. FOREIGN.—Brazil.

It would probably pay to grow this plant more extensively in British Colonies. In December, 1915, Matto Grosso root was valued at 24/- per lb. and Johore root at 20/- per lb. At the same time Cartagena root (*P. acuminata*, Benth. ?) sold for 16/- per lb.

Jalap (*Ipomoea Purga*, Hayne). The tubers.

FOREIGN.—Vera Cruz.

Myrrh (*Commiphora Schimperi*, Engl., and other spp.). Gum-resin.

Somaliland, Arabia.

The best grades sold in February, 1916, for 60/- to 62/6 per cwt.

Nux-vomica (*Strychnos Nux-vomica*, L.).

BRITISH.—India, Burma, Ceylon.

In December, 1915, the seeds were valued at 22/6 per cwt. An article on various species of *Strychnos* is to be found in *K.B.* 1911, p. 281. See also *K.B.* 1917, p. 121.

Ajowan Oil. See Essential Oils.

Oil of Cade (*Juniperus Oxycedrus*, L.).

FOREIGN.—South France.

Opium (*Papaver somniferum*, L.).

BRITISH.—Egypt, India. FOREIGN.—Asia Minor, Persia.

Rhubarb (*Rheum officinale*, Baill., and other spp.). The dried root.

BRITISH.—British Isles. FOREIGN.—North-West China, Tibet.

Santonin (*Artemisia maritima*, L., var. *Stechmanniana*). The dried unexpanded flower-heads.

FOREIGN.—Russian Turkestan.

At present almost unobtainable, price very high.

Squill (*Urginea Scilla*, Steinh.). The bulb.

FOREIGN.—Mediterranean region.

Stavesacre Seeds (*Delphinium Staphisagria*, L.).

FOREIGN.—Italy, Greece, Asia Minor.

Dandelion Roots (*Taraxacum officinale*, Weber).

BRITISH.—British Isles. FOREIGN.—Various European Countries.

Thymol (*Carum copticum*, Bth. and Hk. f., and other plants).

For list of various plants yielding Thymol see Essential Oil list.

Valerian Rhizome (*Valeriana officinalis*, L.).

BRITISH.—Grown in the British Isles. FOREIGN.—Europe, Asia, Japan.

Black Haw (*Viburnum prunifolium*, L.). The bark.

North America.

Cinnamon (*Cinnamomum zeylanicum*, Breyn.). The bark.

BRITISH.—Ceylon.

Chicory (*Cichorium Intybus*, L.). The dried root.

BRITISH.—British Isles. FOREIGN.—Belgium, France.

Castor Oil (*Ricinus communis*, L.). See Fatty Oils.

References to various Drugs.

"The Cultivation of Medicinal Plants in England," in Journal of the Board of Agriculture, No. 6, Sept., 1914; Reprinted as Leaflet No. 288 (obtainable on application to the Secretary, Board of Agriculture and Fisheries).

"The Cultivation of Medicinal Plants in Britain," by E. M. Holmes, in the "Pharmaceutical Journal," Jan. 2nd, 1915, pp.4-5, and Feb. 12, 1916, pp. 161-163.

Kew Bulletin:—

"Liquorice (*Glycyrrhiza glabra*)," 1894, p. 142.

"Ginseng in China," 1902, p. 4.

"Distillation of Camphor," 1907, p. 88.

"Cascara Sagrada" (*Rhamnus Purshiana*), 1908, p. 429; 1912, 393.

"A New Buchu from South Africa" (*Barosma Peglerae*), 1912, p. 326.

Additional Series ix., references to various drugs grown in Nigeria.

"American Medicinal Leaves and Herbs," by A. Henkel, U.S. Dept. of Agriculture, Bureau of Plant Industry, Bulletin No. 219, 1912.

"The Cultivation of Drug Plants in the United States," by R. H. True, U.S. Dept. of Agriculture, Year Book, 1903, pp. 337-346.

"The Commercial Possibilities in Growing Medicinal Plants," by F. A. Miller, in Lilly Scientific Bulletin, No. 5, April, 1914, pp. 163-168.

"The Cultivation of Medicinal Plants," by J. A. Borneman, in American Journal of Pharmacy, Dec., 1912, pp. 546-553.

"The British Pharmacopœia." Published under the direction of the General Council of Medical Education and Registration of the United Kingdom, pp. 1-602. (Constable & Co., Ltd., London, 1914.)

"Potter's Cyclopædia of Botanical Drugs and Preparations," by R. C. Wren, pp. 1-339. (Potter & Clarke, Ltd., London, 1914.)

DYEING AND TANNING MATERIALS.

Cochineal (small hemipterous insects fed on species of *Opuntia* and *Nopalea*).

Foreign.—Canary Islands, from whence in 1914 this country imported 2010 cwts., value £20,122, with 624 cwts., value £5,139, from other Foreign Countries.

Mexico, Guatemala, Java, &c., also produce this dye, and the plant and insect have been introduced to Algeria, Australia and India. See also *K.B.* 1888, p. 170.

Indigo (*Indigofera tinctoria*, L., and *I. arrecta*, *Hochst.*).

British.—India. Foreign.—Java, &c.

The imports from British India to the United Kingdom in 1913 were 3646 cwts., value £48,208, the total imported from all sources in the same year being 4174 cwts., value £54,739. The total amount of indigo imported in 1915 from all sources was 25,157 cwts., value £1,256,712.

Indigofera arrecta is largely grown in Africa, and as a source of Indigo was recommended (1905) by the Director, Royal Botanic Gardens, Kew, to the Government of S. Nigeria for cultivation there in preference to *I. tinctoria*. It was introduced to Java from Natal, and in India, according to Coventry (Watt, Comm. Prod. India), the Java plant shows an increase of 35 per cent. in the amount of green plant cut per acre, and of 45 per cent. increase in vat produce over the ordinary plant of the United Provinces.

Indigofera tinctoria is cultivated for commercial purposes, chiefly in India—Bengal, Madras, Bombay, Sind, &c.—and to some extent in the Straits Settlements, British Honduras, Philippine Islands, Central America, Colombia, and for local use in many tropical countries, including probably the whole of Tropical Africa.

Research work has been fostered for a number of years by the Government of India at specially organised research stations at Sirseah, Pusa, &c., and at the Imperial Institute and the University of Leeds. (See "Report to the Government of India, containing an account of the Research work on Indigo in the University of Leeds," 1905-1907, pp. 1-117, published by Order of the Secretary of State for India, 1908, and various reports issued by the Dept. of Agric., India). Further particulars are given in *K.B.*, 1910, p. 283, and in Add. Ser. ix. Part ii. p. 190.

Logwood (*Haematoxylon campechianum*, L.).

British.—West Indies—Jamaica, Mauritius, British Honduras, &c. Foreign.—Hayti, San Domingo, Mexico, &c.

In 1913, 8137 tons, value £42,534, from British Possessions, and 1492 tons, value £8,167, from Foreign Countries, were imported into the United Kingdom. A recent market report quotes £8 to £9 per ton.

The tree is a native of Central America and is shipped largely from Yucatan, where the Logwood cutters distinguish four varieties of the wood—"Tinta Negra," "Tinta Maria," "Tinta Catzim," and "Tinta Amarilla Catzim," according to the dye content. It has been naturalised in Jamaica, the most prominent British source of the wood, and has been introduced to Mauritius, Nigeria, and other Colonies.

"Bastard Logwood" is of no value for dyeing purposes, and the cause of the difference in the wood appears to be uncertain; botanically, no differences can be observed, and no distinguishing characters are evident until the trees are cut. Experiments have been undertaken (1903) at Hope Gardens, Jamaica, and the New York Botanical Gardens with seedlings of the trees producing normal and abnormal dye-wood to find out if possible the cause of this difference. For further particulars see *K.B.*, 1916, p. 221, and Add. Ser. ix. Part ii. p. 253.

Fustic (*Chlorophora tinctoria*, Gaud.).

British.—West Indies, Guiana. Foreign.—Brazil.

A dye-wood. Value on the London market £6 to £7 per ton.

The "Osage Orange" (*Maclura aurantiaca*, Nutt.) has been used in Texas as a dye-wood, and is recommended as a substitute for Fustic (see Agric. News, Barbados, Aug. 14th, 1915, p. 262). The tree is a native of North America, and the wood known there as "Bow wood" is largely used for fence-posts, paving blocks, &c.

Camwood (*Baphia nitida*, Lodd.).

British.—West Africa.

The heart wood is used as a dye, the value of which may vary from £5 to £12 per ton. A good deal of information will be found in *K.B.*, 1906, p. 373; 1908, p. 192; and Add. Ser. ix. Part ii. p. 246.

Barwood (*Pterocarpus Soyauxii*, Taub.).

Native of West Tropical Africa; the wood for dyeing was formerly of some importance in England, but it now appears to be unsaleable. For particulars of Barwood see *K.B.*, 1906, p. 373; 1908, p. 192; and Add. Ser. ix. Part ii. p. 242.

Sappan Wood (*Caesalpinia Sappan*, L.).

A red dye-wood imported into this country chiefly from Siam and the Philippines, but not of so much importance as formerly.

The Philippine production is exported largely to China. In India, where the tree is cultivated, the wood is chiefly used locally. The tree is being propagated for distribution by the Dept. of Agriculture, S. Nigeria. See *K.B.*, 1916, p. 211, and Add. Ser. ix. Part ii. p. 252.

Arnatto or Annatto (*Bixa Orellana*, L.). The fleshy covering of the seeds.

British.—West Indies, Ceylon, &c. Foreign.—Chiefly from South America. Prepared dye and seeds imported.

The price of the dye on the London market may vary from 1/- to 2/- per lb., and the seeds 4½d. to 6d. per lb., but the demand is more or less stationary, and has always been distinctly limited. Native of Tropical America, naturalised in West Africa, and distributed by cultivation to most of the tropical Colonies. For particulars see *K.B.*, 1887, July, p. 1; September, p. 1; and 1890, p. 141.

Woad (*Isatis tinctoria*, L.). The plant.

An ancient industry until lately carried on near Wisbech, Cambridgeshire, and at Boston and Holbeach, Lincolnshire (see "Nature," Nov. 12th, 1896, pp. 36-37, and *K.B.* 1902, p. 15). The dye was used in combination with indigo.

Safflower (*Carthamus tinctorius*, L.). The flowers.

British.—India. Foreign.—France, Spain, &c.

As a dye for silks and cottons, Safflower, once of considerable importance, is, in common with Madder (*Rubia tinctorum*) and others, now almost forgotten in this country, owing to the development of synthetic dyes, though in India it appears to have lost nothing of importance for local use.

The imports of Safflower into the United Kingdom 50 or 60 years ago were calculated in tons (405 tons in 1847, 506 tons in 1848, &c.), the price according to quality being from £1 to £8 per cwt., imported from Bombay and Bengal. The last year in which returns are shown by the Customs is 1899, when 20 cwt., value £62, came in from India. The exports of the dye from India now go mainly to Hong Kong.

The plant is cultivated in the Sudan, Nubia, Senaar, India, China, Abyssinia, S. Europe, &c. Further details will be found in *K.B.* Add. Ser. ix. Part iii. p. 392.

Saffron (*Crocus sativus*, L.). Stigmas of the flowers.

Foreign.—Grown for commercial purposes in France, Spain, Italy, &c., formerly used as a dye, but has been superseded by cheaper materials, the principal use at the present time being as a condiment or flavouring agent.

Quercitron Bark (*Quercus discolor*, Ait.), from North America; used as a dye and for tanning purposes.

Persian or Yellow Berries (*Rhamnus infectoria*, L.), grown in Asia Minor, Persia, &c.

Gambier (*Uncaria Gambier*, Roxb.). Extract from the leaves and shoots.

British.—Straits Settlements and Dependencies. Foreign. Dutch Possessions in the East Indies.

In 1913 81,352 cwts., value £115,168, from British Possessions, and 20,360 cwts., value £26,858, from Foreign Countries, or a total of 101,712 cwts., value £142,026, were imported into the United Kingdom. In 1915 the total from all sources imported to this country amounted to 208,748 cwts., value £306,698.

The plant has been recommended by Kew for cultivation in various Colonies, West Africa, West Indies, &c., but so far it does not appear to have been commercially successful anywhere other than in or near the original countries of production. Used for dyeing and tanning. Additional information will be found in *K.B.* 1889, p. 247, Add. Ser. ix. Part iii. p. 346.

Myrobalans (*Terminalia Chebula*, Retz.).

British.—India, Burma.

In 1913 564,462 cwts., value £176,621, from British Possessions, chiefly British India, and 760 cwts., value £234, from Foreign Countries, or a total of 565,222 cwts., value £176,855, were imported into the United Kingdom. In 1915 the total from all sources imported to this country amounted to 778,984 cwts., value £292,297.

It is the dried fruits that come into commerce, and, in addition to being used as a tanning material, a valuable yellow or brown dye is extracted. See also *K.B.* 1909, p. 209.

Sumach (*Rhus* spp.). Leaves and Twigs.

British.—Cyprus. Foreign.—Spain, Italy, Tunis, &c.

In 1913, 396 cwts., value £130, from Cyprus, and 163,704 cwts., value £83,031, were imported into the United Kingdom. In 1915 the total from all sources imported amounted to 143,333 cwts., value £84,040.

Three sorts of Sumach come into commerce (1) "Venetian Sumach," or "Young Fustic," the young twigs of *Rhus Cotinus*, L., a S. European species, yields a bright yellow dye, (2) "North American Sumach" (*Rhus glabra*, L.), and (3) the Sumach of the Mediterranean Region, the tanning material con-

sisting chiefly of the powdered leaves of *Rhus Coriaria*, L., a hardy shrub growing on rocky slopes in Sicily and elsewhere, cultivated near Palermo.

The Sumach plant (*Rhus Coriaria*, L.) has been successfully introduced to Australia, where it is said to thrive well in the dry plains of the Wimmera District. Samples of Sumach from Melbourne plants shown at the Exhibition of 1863 are in the Kew Museum. Further particulars are given in *K.B.* 1895, p. 293.

Valonia (*Quercus Aegilops*, L., and vars. *macrolepis* and *Ungeri*).

Foreign.—Greece, Smyrna.

In 1915 142,456 cwt., value £101,922, were imported into the United Kingdom.

The Acorn-cups are used by tanners and dyers.

Gall-Nuts or **Mecca Galls** (*Quercus Lusitanica*, Lam., var. *infectoria*, A. DC.).

Foreign.—Asia Minor.

Chinese Galls (*Rhus semialata*, Murray).

Foreign.—China and Japan.

Used for tanning, and mentioned as being used for dyeing in the Silk Industry at Lyons (see *K.B.* 1900, p. 5).

Divi-divi (*Caesalpinia coriaria*, Willd.).

British.—West Indies. Foreign.—South America, Venezuela, &c.

Native of Central and South America. Cultivated in India, Java, Australia, Gold Coast, Nigeria, East Africa, &c.

The pods are the part used for tanning, and an extract from them is also a useful dye. Additional information will be found in *K.B.* Add. Ser. ix. Part ii. p. 250.

Oak Bark (*Quercus* spp.).

The principal native tanning substance, and imported from the Continent of Europe, Belgium, &c.

Large quantities (324,070 cords, value 3,533,862 dollars) of Oak-bark, and also of the extract (36,930,861 lbs., value 703,805 dollars) are used in the United States annually (see Board of Trade Journ., June 30th, 1912) for tanning purposes.

Hemlock Spruce Bark (*Tsuga canadensis*, Carr., "Eastern Hemlock"; *Tsuga Mertensiana*, Carr., "Western Hemlock").

British.—Canada. Foreign.—United States.

Large quantities used in the United States for tanning. See also *K.B.* 1912, p. 81.

Mangrove Bark (*Rhizophora* spp.).

British.—East Africa, Zanzibar, &c. Foreign.—Mozambique. Chiefly from *Rhizophora mucronata*, Lam., a species also found on the shores of India, Burma, &c., from whence also the bark is probably obtained for tanning in this country. Watt (Comm. Prod. India), states that it is exported from Mergui to Rangoon, and a considerable trade is also done in it from the Perak Coast.

"Gamfort" is a trade name for an extract (like "Cutch"), made on the coast of Borneo, near Sarawak. There is a sample of this in the Kew Museum, and it is believed to be obtained from a Mangrove bark, probably that of the species mentioned.

The best Mangrove bark or extract is not so acceptable to tanners as Oak Bark, Valonia, Quebracho, Mimosa Bark, &c.; the principal objection is its deep red colour, and it is only considered satisfactory for tanning leather when used in combination with better class substances. Some particulars of the "Cutch" Industry from Mangrove bark in Borneo are given in Journ. Soc. Arts, July 23, 1909, p. 737. See also *K.B.* 1892, p. 227; Add. Ser. ix./Part ii., p. 304.

Quebracho Colorado (*Quebrachia Lorentzii*, Griseb.). Wood and Extract imported chiefly from the Argentine. *Quebrachia Morongii*, Britton, is known as "Quebracho Colorado" in Paraguay, where the wood is ground up and used for tanning purposes.

Wattle Bark or **Mimosa Bark** (several species of *Acacia*, notably *A. mollissima*, Willd., *A. dealbata*, Link, *A. pycnantha*, Bth., &c.).

British.—Australia, Natal.

The cultivation of Wattle bark, which has been very successful in Natal (with *Acacia mollissima*, introduced from Australia), has also been undertaken in New Zealand, Hawaii, California, &c. Information about *A. saligna* especially will be found in *K.B.* 1893, p. 370.

Mallet Bark (*Eucalyptus occidentalis*, Endl., var. *astringens*).

British.—West Australia.

As a tanning substance this is comparatively new, some large shipments have been made, beginning about 1904, and the bark is regarded as a strong competitor of the more widely used Mimosa or Wattle Bark. See also *K.B.* 1911, p. 114.

Cutch or **Catechu** (*Acacia Catechu*, Willd.).

British.—India, Burma, &c.

The extract for tanning purposes is obtained by boiling the chips of the heart-wood of the tree. It is known in commerce as "Dark Catechu," "Black Catechu," "Pegu Catechu," or "Terra Japonica." The last name is also applied to the extract of *Uncaria Gambier*, Roxb. See also *K.B.* 1894, p. 323.

Chestnut Extract (*Castanea sativa*, Mill.). Extract from the wood.

Foreign.—France, Corsica, North America, &c.

In the foregoing list pages 270-273 are Dyes and pages 273-276 are Tanning materials, though some of the products may be used for both purposes. The imports into this country, with the corresponding values, are taken from "The Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions," Vol. i., 1915; and "Accounts Relating to Trade and Navigation of the United Kingdom, Dec., 1915." Figures are not readily separated from the returns given in reference to some of the products mentioned in the above notes, as, for instance, "Cutch" obviously includes the extract from Mangrove Bark (*Rhizophora mucronata*, &c.), and that from the wood of *Acacia Catechu;* the Tanning Barks include those obtained from *Acacia*, *Rhizophora*, and *Eucalyptus*, &c., but the absence of the figures herein may, perhaps, not so much matter when it is remembered that it is important in the case of all tanning materials and most dyes that large and regular quantities, as well as quality, must be assured to sustain the market in those well known, or before any new product can be accepted by the trade, and those enumerated are calculated to meet these requirements.

There are many Native Vegetable Dyes that might be mentioned in addition to "Woad" (*Isatis tinctoria*), but the cost of collecting and preparing the plants would probably be much in excess of that of the more reliable dyes now obtained from the Colonies and Foreign Countries, and it is not likely that the quantity available would be sufficient for general purposes. Many of the Native Dyes were formerly used, and are still in use at the present day, especially in the Highlands of Scotland, where those principally used are obtained from *Genista tinctoria*, L., *Reseda Luteola*, L., *Calluna vulgaris*, Salisb., *Iris Pseudacorus*, L., &c.

In the *Kew Bulletin* for 1894, p. 322, it is stated that "Competition with Aniline has ruined many of the Indian Dyes, such as 'Safflower' (*Carthamus tinctorius*, L.), 'Madder' (*Rubia cordifolia*, L.), but there seems no good reason why others should not take their places, either as regular crops or as important forest products. Among the former may be specially mentioned the 'Chay Root' (*Oldenlandia umbellata*, L.) and 'Al' (*Morinda citrifolia*, L.), which might be regularly and extensively cultivated, as these plants furnish dyes of a purity and depth of colour that defy imitation." The following Dyes and Tans have also been discussed in the *Kew Bulletin*:—

"Red Guinea Corn (*Sorghum vulgare*)," 1891, p. 219, cultivated as a red-dye in Yoruba.

"The Clove as a Dye Plant (*Eugenia caryophyllata*)," 1894, p. 417; used for dyeing in the Seychelles; reported on for Kew by Prof. Hummel, of the Yorkshire College, Leeds, "As a dye stuff it is of little value."

"Shu Lang Root (*Dioscorea rhipogonoides*)," 1895, p. 230, a dye-yam of China; extensively used in Pakhoi in dyeing coarse native cotton cloth and fishing nets a dark brown or tan colour, and for dyeing grass-cloth (*Boehmeria*).

"Indian Yellow or Piuri," 1890, p. 45, obtained from the urine of cows fed on Mango leaves in India.

"Maqui Berries (*Aristotelia Maqui*)," 1890, p. 34, used for colouring wine; shrub common in Chile.

"Artificial Indigo," 1898, p. 33.

"West African Indigo Plants," 1888, p. 74.

"Yoruba Indigo (*Lonchocarpus cyanescens*)," 1888, p. 268, and Add. Series ix. Part ii., p. 244.

"Paraguay Indigo (*Eupatorium laeve: E. tinctorium*)," 1892, p. 179; correspondence with the Foreign Office and report by Prof. Hummel.

"Shinia in Cyprus (*Pistacia Lentiscus*), 1897, p. 421, and 1898, p. 190.

"Tengah Bark (*Ceriops Candolleana*)," 1897, p. 91, used at Singapore for tanning and dyeing; report by Prof. Hummel, Leeds.

"Fungus Gamboge (*Polyporus hispidus*)," 1899, p. 23, specimens examined for Kew by Prof. Hummel, the Yorkshire College, Leeds, who reports "the colours obtained are not bright enough, nor is the fungus sufficiently rich in colouring matter to render it of commercial value in Europe."

"Siam Gamboge (*Garcinia Hanburyi*)," 1895, p. 139.

"Persian Zalil (*Delphinium Zalil*)," p. 111, and 1895, p. 167, where it is stated that "Although quite a good dye stuff for native use, the comparatively low colouring power of the flowers will prevent it from finding any employment in Europe."

"Geranium Wallichianum as a dye plant," 1896, p. 29; report by Prof. Hummel on the dye, and also one by Prof. Proctor as to suitability for tanning leather.

"Gambier Plants (*Uncaria Gambier*)," 1891, p. 106; correspondence between Kew and the Colonial Office on the introduction of the plant to the West Indies.

"Cape Sumach (*Colpoon compressum*)," 1898, p. 18.

"Valonia in Cyprus," 1888. p. 163; correspondence between the Royal Botanic Gardens, Kew, and the Crown Agents for the Colonies.

"Canaigre (*Rumex hymenosepalum*)," 1890, p. 63; 1894, p. 167; 1897, p. 200.

"Sumach, North American (*Rhus glabra*)," 1895, p. 293.

PAPER-MAKING MATERIALS.

Esparto (*Stipa tenacissima*, L.); part used, the plant-culms and leaves.

Foreign.—Spain, Algeria, Tunis, Tripoli.

An important fibre for paper-making. The imports in 1913 amounted to 204,957 tons; in 1914, 183,144 tons; in 1915, 137,538 tons; and in 1916, 149,358 tons; the average current prices on the 15th of December of each year mentioned being £3 5s. to £5 per ton, £3 10s. to £5 10s., £4 to £6, and £5 7s. 6d. to £6 2s. 6d. (based on a sea freight of 60s. per ton) per ton respectively (see Messrs. Ide & Christie's Monthly Circular).

Wood Pulp: **White Spruce** (*Picea alba*, Link); **Red Spruce** (*P. rubra*, Link); **Black Spruce** (*P. nigra*, Link); **Norway Spruce** (*P. excelsa*, Link).

British.—Newfoundland, Canada. Foreign.—Norway, Sweden.

The imports of Mechanical (Wet) Wood Pulp into the United Kingdom in 1915 included from Canada 37,501 tons, value £115,469; from Newfoundland, 25,232 tons, value £71,245. The principal foreign sources for this class of pulp are Russia (no returns for 1915), Sweden—imports in 1915, 135,078 tons, value £389,930; Norway, imports in 1915, 342,917 tons, value £922,378. Other forms of Wood Pulp, as "Chemical Dry, Bleached," "Chemical Dry, Unbleached," "Chemical Wet," "Mechanical Dry," chiefly foreign sources, Russia, Sweden, Norway, &c., were imported in the same year to an extent of more than 400,000 tons, value exceeding £3,800,000 (see Annual Statement, Trade of the United Kingdom, i. 1916, p. 184).

Hedychium coronarium, Koln., a plant of the Natural Order *Zingiberaceae*, native of India; distributed to Ceylon, Malacca, Central America, West Indies, West Africa, Mauritius, &c., naturalised in Brazil.

This plant, as a new source of paper-pulp, has been investigated by Messrs. Clayton Beadle & Stevens, 15, Boro., London Bridge. The experiments were made with dried material from Brazil, and with fresh stems grown in the Royal Botanic Gardens, Kew, and later with a supply of dried material from the Royal Botanic Garden, Sibpur, Calcutta (see *K.B.* 1912, p. 373; 1914, p. 165; and 1917, p. 104, for detailed accounts).

Amomum hemisphaerica, K. Schum., native of Java.

Alpinia nutans, Rosc., found in Hong Kong, Eastern Himalaya, Malay Peninsula, and the West Indies. Also in Guatemala, Venezuela, Surinam, Brazil, Formosa, and Cochin China.

Both these plants are similar in habit to the above-mentioned, and have also been investigated by Messrs. Clayton Beadle & Stevens for paper-making (see *K.B.*, 1912, p. 377).

In the *Kew Reports*, 1874-1880, some particulars of the following plants for paper-making are given:—

Lygeum Spartum, "Esparto Grass," 1876, p. 24; 1877, p. 37; *Stipa* (*Macrochloa*) *tenacissima*, "Esparto," 1876, p. 24; 1877,

p. 37; 1879, p. 33; *Adansonia digitata*, "Baobab," 1876, p. 24; *Fimbristylis spadicea*, 1876, p. 25; *Heliconia Bihai*, 1876, p. 25; *Lepidosperma gladiatum*, 1876, p. 25; *Uniola virgata*, 1876, p. 25; *Calotropis gigantea*, 1877, p. 37; 1880, p. 52; 1881, p. 32, 45; *Broussonetia papyrifera*, 1879, p. 33; *Yucca brevifolia*, 1878, p. 44; *Eriophorum comosum*, 1878, p. 45; *Phragmites communis*, 1876, p. 25; "Bamboo," 1876, p. 24; 1877, p. 35.

Later papers have appeared in the *Kew Bulletin* as follows:—

"Bhabur Grass (*Ischaemum angustifolium*)," 1888, p. 157; 1894, p. 367; Add. Ser. ii. "Vegetable Fibres," p. 253.

"Esparto (*Stipa tenacissima*)," 1898, p. 318.

"Lalang Grass (*Imperata arundinacea*)," 1909, p. 55.

"Marram Grass (*Ammophila arenaria*) for Paper-making," 1912, p. 396; and 1913, p. 363.

"Streblus Paper (*Streblus asper*)," Add. Ser. ii., "Vegetable Fibres," p. 46.

The specimens referred to are in the Museums at Kew, and there are many more that have been contributed from time to time which do not appear to have attracted any special notice.

The following plants have been under consideration in comparatively recent years, but their use does not yet appear to have become general for paper-making:—

Bamboo, *Bambusa polymorpha*, Munro; &c.

There are specimens of Bamboo paper in the Museum, contributed more than 40 years ago by Mr. Routledge, who published in 1875 a pamphlet on "Bamboo as a Paper-Making Material." In it he stated: "Of all the fibre-yielding plants known to botanical science there is not one so well calculated to meet the pressing requirements of the Paper-trade as 'Bamboo,' both as regards facility of economy and production, as well as the quality of the 'Paper Stock' which can be manufactured therefrom. . . . I have made 'Paper Stock' from a stem of *Bambusa vulgaris*, Schrad., sent me by Dr. Hooker, from the Royal Botanic Gardens at Kew, which, as measured by the gardener in the Palm-house, grew at the rate of three feet in a single week."

The Indian Forest Record, Vol. iv. Part v., contains a "Note on the Utilisation of Bamboo for the Manufacture of Paper-Pulp," by R. S. Pearson, printed on paper made from *Bambusa polymorpha*.

A sample of Bamboo Paper Pulp, made by the Société des Pulpes et Papeteries du Tonkin, presented to the Museum by Messrs. Ide & Christie in 1913, formed part of the first supplies in quantity that had come, so it was believed, from the East to England.

Amongst recent publications on this subject may be mentioned "Bamboo Fibre as a Paper Material," in "The Commercial Products of India," by Sir G. Watt (1908), pp. 108-110; and "Report on the Investigation of Bamboo as a material for Production of Paper-pulp," by W. Raitt, in the Indian Forest Records, Vol. iii. Part iii. 1912 pp. 1-37.

Common Reed (*Phragmites communis*, Trin.); two specimens of paper in the Museum, one made of reeds grown on the banks of the Tay, near Errol, 1876, and the other of reeds grown at Keyhaven, near Milford-on-Sea, 1916; but there appears to be no published information on this plant as a paper-making material.

Rice Grass (*Spartina Townsendii*, L.); specimen in the Museum of paper made from plants collected at Poole Harbour, Nov., 1916.

An article on this plant, "Rice Grass in Poole Harbour: Possible Use in Paper Making," will be found in Bournemouth Visitors' Directory, 1916.

Kaoliang (*Andropogon Sorghum*, var. *vulgaris*, Hack.: *Sorghum vulgare*, Pers.); specimen of "Kaoliang Paper" in the Museum from Dairen, Manchuria, received from the Japan-British Exhibition, 1910. In reference to this paper, the British Acting-Consul at Dairen (see Board of Trade Journal, March 9th, 1911, p. 531) reports that, "owing to the keen demand for the kaoliang cane for sundry domestic uses, it is impossible to obtain it for paper making in large quantities and at moderate prices, and there is consequently little prospect of the development of a kaoliang paper making industry in Manchuria. The cost of production of kaoliang pulp is slightly less than 5 sen (1¼d.) per lb." This grass is cultivated throughout India, Ceylon, and Africa, more particularly in the hotter parts of these countries, and in most, probably all, of our tropical Colonies.

Elephant Grass (*Pennisetum purpureum*, Schum.); this grass as a paper-making material is fully dealt with in the Bulletin of the Imperial Institute, xi. 1913, pp. 68-70. The material experimented with was from Uganda, and in the report it was stated: "On account of the light and bulky nature of 'elephant grass' it is very unlikely that the stems could be profitably shipped to Europe for paper-making, as they would probably only realise about the same price as Esparto grass of average quality. If, however, the stems were converted into pulp in Uganda by treatment with caustic soda, it is possible that a remunerative industry might be carried on, since the pulp would probably be of approximately the same value for paper-making as wood-pulp prepared by the soda process." *K.B.*, 1912, p. 309.

Papyrus (*Cyperus Papyrus*, L.). According to the Journal of the Royal Society of Arts, July 9th, 1915, p. 772, some experiments were conducted in 1908 at the Wellcome Tropical Research Laboratories, Khartoum, with this plant for making pulp, and experiments on a larger scale have been carried out by Messrs. Tullis, Russell & Co., and by Messrs. Thomas & Green, under the auspices of Messrs. Cross & Bevan. The results indicated a valuation about equal to Esparto.

The following are recent publications on the subject:—

"Paper and Paper Materials," in the Commercial Products of India, by Sir G. Watt, pp. 861-868.

"Paper Making Materials," in Colonial Report, Miscellaneous Series, No. 58, 1909 (Selected Reports from the Scientific and Technical Department, Imperial Institute), pp. 119-128.

"New Sources of Supply for the Manufacture of Paper," by Clayton Beadle and Henry P. Stevens, in Journal of the Royal Society of Arts, February 14th, 1913, pp. 347-363.

"The Empire's Resources in Paper-Making Materials," by S. Chas. Phillips, in the Journal of the Royal Society of Arts, May 21st, 1915, pp. 613-636.

FIBRES.

Cotton (*Gossypium* spp.). The seed hairs.

British.—India, East Africa, West Africa, West Indies, Egypt (from 1915) and other Possessions. The imports into the United Kingdom were in 1913—71,915,000 lb. value £1,931,963, and in 1915—566,954,700 lb. value £17,482,608. Foreign.—United States, Egypt, Brazil, Chili, Peru, Hayti, San Domingo, Turkey, G. E. Africa, Port. E. Africa, &c. The imports into the United Kingdom were in 1913—2,102,384,600 lb. value £68,638,584, and in 1915—2,080,699,500 lb. value £47,190,041.

The amount imported from Egypt in 1913 (then under Foreign Countries) was 402,669,400 lb. value £17,642,358. This under normal conditions would therefore be the most important source from British possessions and the United States the principal Foreign Source.

K.B. Add. Ser. ii. p. 11; Add. Ser. ix. part i. p. 76.

Kapok (*Eriodendron anfractuosum*, DC.). The seed hairs.

British. India, Ceylon, Togoland. Foreign.—Java, East Africa. Value 1913—2d. to 6¼d. per lb.; in 1915—Indian 4d. to 6d., Ceylon 5½d., Java 8d. to 8½d. spot, 7½d. c.i.f. per lb.

K.B. Add. Ser. ii. p. 27; Add. Ser. ix. part i. p. 87; 1913, p. 236.

Akund (*Calotropis gigantea*, Br., and *C. procera*, Br.). The seed hairs.

British.—India. Value 1915—2½d. to 3½d. per lb.

K.B. Add. Ser. ix. part iii. p. 463.

Java is the most important source of Kapok. It is there grown in plantations, the produce being exported chiefly to Holland. The cultivation has recently been taken up in Togoland and East Africa (see *K.B.* 1913, p. 236). Akund is inferior to Kapok but is classed with it in commerce; it has only recently come into the English market. Both Kapok and Akund are common in the Colonies of Tropical Asia and Trop. Africa and might be readily extended by cultivation.

Sisal Hemp (*Agave rigida*, Mill., var. *sisalana*, Pers.). Leaf fibre.

British.—India, East Africa, Natal, Bahamas. Foreign.—Mexico, East Africa. Value 1913—Indian, £17 to £27 per

ton, Mexican £26 10s. to £27 10s. per ton; in 1915—Indian £39, Natal £36 10s., Mexican £37 to £38.

The figures showing the general imports of this fibre are not readily accessible, being included under the broad term "Hemp". Mexico is the principal source, 824 tons, value £24,459. coming from that country to the United Kingdom in 1913, but large quantities are shipped to the United States; 949 tons, value £31,210, were imported into England in 1913. British East Africa and the Bahamas are perhaps the most successful Colonies in the production of this fibre, but considerable attention is being given to it in India, Jamaica, Natal, Uganda, Nyasaland, West Africa, Fiji, &c., and there appears to be no reason why the plant should not be grown successfully in any Colony possessing a hot climate and dry calcareous soil.

K.B. Add. Ser. ii. p. 130; 1908, p. 300; 1912, p. 354; 1913, p. 231; 1914, p. 350.

Mauritius Hemp (*Furcraea gigantea*, Vent.). Leaf fibre.

British.—Mauritius and St. Helena. Value 1913—£25 to £29 per ton; in 1915 £34 to £35 per ton.

The plant is under cultivation in India, Ceylon, Nyasaland, &c.

K.B. Add. Ser. ii. p. 208; 1916, p. 169.

Manila Hemp (*Musa textilis*, Née). Stem fibre.

Foreign.—Philippines, Java.

Manila hemp is the best of the white fibres used for making rope, which includes the two hemps above mentioned.

The plant has been cultivated in British North Borneo, and has been introduced from Kew to India, the West African and West Indian Colonies, &c.

K.B. Add. Ser. ii. pp. 95, 106.

New Zealand Hemp (*Phormium tenax*, Forst.). Leaf fibre.

British.—New Zealand, St. Helena. 21,824 tons, value £649,170, imported in 1913; and 14,512 tons, value £397,858, in 1915 to this country, from New Zealand.

This plant does not appear, so far, to have been grown on a commercial scale in any other Colony.

Flax (*Linum usitatissimum*, L.). Bast fibre.

British.—Ireland, Canada. Foreign.—Russia, Germany, Netherlands, Belgium, France, &c. Imports into the United Kingdom from the Foreign Countries enumerated in 1913—84,222 tons value £4,178,782, and from British Possessions 1913—48 tons, value £1,347.

The plant is under experimental cultivation in Cyprus, East Africa Protectorate, Transvaal, Orange River Colony, India (as a fibre plant, but an important source of the seed: see "Linseed"). In British East Africa Protectorate "the experiments

which have taken place during the last few years have had satisfactory results, and practical interest in this crop is now being displayed by a number of settlers. Some of the samples sent home were valued as high as £55 per ton and the yield also compares favourably with that in other countries" (Colonial Report Annual, No. 840, 1915, p. 22).

K.B. 1913, p. 319.

Sunn Hemp (*Crotalaria juncea*, L.). Bast fibre.

BRITISH.—India.

India, where the plant is largely cultivated, would appear to be the only commercial source, over 5000 tons a year being exported to England.

The plant is found in Ceylon and Burma; distributed to Malaya and Australia; introduced to Lagos Botanic Station, seeds being sent from Kew in 1888; cultivated experimentally in Ceylon and Italy.

K.B. Add. Ser. ix. part ii. p. 181.

European Hemp (*Cannabis sativa*, L.). Bast fibre.

BRITISH.—India. FOREIGN.—Russia, Germany, Italy, Japan, Belgium, France, Austria-Hungary, United States. The principal Foreign source is Russia, from whence in 1913 this country imported 12,818 tons, value £432,201, and in 1915—5321 tons, value £260,368. According to Watt (Comm. Prod. India), the exports of "Hemp" from India are mainly in the afore-mentioned "Sunn" or "Sann" Hemp (*Crotalaria juncea*).

Jute (*Corchorus capsularis*, L.). Bast fibre.

BRITISH.—India; principal centre of the trade, Bengal. Imports into the United Kingdom 1913—347,548 tons, value £9,182,226.

Cultivated experimentally in Nigeria and other parts of West Africa.

K.B. Add. Ser. ix. part i. p. 109.

Bimlipatam Jute (*Hibiscus cannabinus*, L.). Bast fibre.

BRITISH.—India; principal centre of the trade, Madras. Imported as Jute in association with the above mentioned. Cultivated in Nigeria and French West Africa. Grows wild in the Gambia, Sudan, and widely distributed in Tropical Africa where it is believed to be indigenous. The plant is also known as "Ambari Hemp," "Deccan Hemp," "Indian Hemp," "Bastard Jute," etc.

K.B. Add. Ser. ii. p. 9; ix. part i. p. 70.

China Jute (*Abutilon Avicennae*, Gaertn.). Bast fibre.

FOREIGN.—China.

Imported into this country as "China Jute," but usually in association with Jute proper (*Corchorus capsularis*). Grows wild in N.W. India.

K.B. Add. Ser. ii. p. 259.

Para Piassava (*Leopoldinia Piassaba*, Wallace). Amazon Region; principal centre of the trade, Manaos, shipped from Para.

K.B. Add. Ser. ii. p. 250.

Bahia Piassava (*Attalea funifera*, Mart.). Brazil. Value, £46 to £50 a ton (1915).

K.B. Add. Ser. ii. p. 248.

West African Piassava (*Raphia vinifera*, Beauv.). Petiole fibre; imported from Nigeria and the Gold Coast, also from Liberia and French Guinea. It is also known in the trade as "Lagos Bass." Value £30 to £32 a ton (1915).

K.B. Add. Ser. ii. p. 228; 1910, p. 169.

Madagascar Piassava (*Dictyosperma fibrosum*, Wright). Madagascar. Value, £45 to £60 per ton (1915).

K.B. Add. Ser. ii. p. 227.

These various Piassava fibres obtained from the sheathing bases of the leaves are used for making brushes. The palms from which they are obtained are all growing wild in their respective localities and apparently not under cultivation for fibre production.

A similar fibre, classed as "Piassava" is obtained from the sheathing bases of the "Palmyra Palm" (*Borassus flabellifer*, L.), native of India, Ceylon and Tropical Africa, value £45 to £48 for good, £36 to £50 for dyed and sized, and also from the "Kittool" or "Kitool" Palm (*Caryota urens*) found in India, Ceylon, Malaya, etc. The exports from India are not important and the fibre comes principally from Ceylon, this Colony having supplied the London Market for more than 50 years.

Rafia or **Raffia** (*Raphia pedunculata*, Beauv.). A Madagascar Palm. This is the principal source, being the cuticle of the young leaves, dried; it has also been obtained from *Raphia vinifera*, of West Africa.

K.B. Add. Ser. ii. p. 232.

Coir (*Cocos nucifera*, L.). The fruit husk.

British.—India and Ceylon, where the industry has been long established. Experiments have been made at Lagos in the production of this fibre (see *K.B.* Add. Ser. ii. Veg. Fibres, p. 245). The palm is common in all tropical Colonies, near the sea.

K.B. Add. Ser. ii. p. 245.

China Grass (*Boehmeria nivea*, Gaud.) and **Ramie** or **Rhea** (*Boehmeria nivea*, Gaud. var. *tenacissima*). Bast fibre. Native of China. Under experiment in India, and there is perhaps hardly a British Colony in which this fibre has not been under experiment during the past half century or so, but so far with-

out any conspicuous success on a commercial scale. A recent Trade Return (Messrs. Ide & Christie's Monthly Circular, December 15th, 1915) states: "China Grass.—Some little enquiry is about, but so far no result.—38s. to 45s. Rhea.—No business."

K.B. Add. Ser. ii. p. 52.

Bowstring Hemp (*Sansevieria* spp.). Leaf fibre.

British.—East Africa.

Cultivated experimentally in various parts of Tropical Africa, Sudan, Rhodesia, Transvaal, Nyasaland, East Africa Protectorate, Nigeria, Gold Coast, etc., also in South Australia, India, Ceylon, etc.

The genus *Sansevieria* includes many valuable species yielding fibres all covered by the term "Bowstring Hemp." It has been given considerable attention at Kew for some years past in order to determine the species, chiefly from living plants which have flowered from time to time. The results are embodied in a recent Monograph of all the known species, 54 in all (see *K.B.* No. 5, 1915, pp. 185-261). The fibres of many of the species from the various Tropical African Colonies have been under investigation at the Imperial Institute (see Colonial Report, Misc., No. 58, 1909).

K.B. Add. Ser. ii. p. 114.

The above-mentioned are the principal fibres of commerce. The prices in general are those of the London Market (from Messrs. Ide & Christie's Monthly Circular, December 15th, 1913, and December 15th, 1915). The imports with their corresponding values are taken from "The Annual Statement of the Trade of the United Kingdom," Vol. i. 1915, or "Accounts Relating to Trade and Navigation of the United Kingdom," December, 1915.

The following have been under examination at the Imperial Institute and at the Royal Botanic Gardens, Kew:—

Hibiscus esculentus, L., the "Okra" of West Africa. Native of India; distributed over the whole of Tropical Africa and naturalised in all tropical and many sub-tropical Countries.

Hibiscus lasiocarpos, Cav. (?) from Sierra Leone.

Hibiscus lunariifolius, Willd., Native of India; widely distributed in Tropical Africa; cultivated as "Ramma" or "Rama" in Kontagora, Northern Provinces, Nigeria.

Hibiscus quinquelobus, Don, the "Kowe" or "Corwey," of Sierra Leone, "Onigozi," of Benin.

Honckenya ficifolia, Willd., Sierra Leone, Gold Coast, Nigeria, the "Bolo-bolo" fibre of the Yorubas.

Sida rhombifolia, L. Widely distributed in Tropical Africa and in the Tropics of the Old and New Worlds.

Triumfetta cordifolia, Guill. et Perr., and *T. rhomboidea*, Jacq., widely distributed in Tropical Africa.

Urena lobata, L., "Toja" fibre of Lagos, "Bolo-bolo" of Yoruba, "Aramina," "Guaxima," or "Carapicho" of Brazil;

widely distributed in tropical regions of both hemispheres. *Urena sinuata*, L., a similar plant, as widely distributed and passing at times under the same native names; the name "Rama" as applied to *Hibiscus lunariifolius* is also applied to this plant in Nupe, Nigeria.

The above ten fibres would all be classed as "Jute" in the trade, though but two genera (*Triumfetta* & *Honckenya*) belong to the same Order (*Tiliaceae*), the remainder belonging to *Malvaceae*, and they are all recommended as efficient substitutes for the true or Bengal Jute (*Corchorus capsularis*). All these are bast fibres. Some particulars of them, with references to literature, are given in *K.B.* Add. Series ix. part i.

Many other fibres, too numerous to enumerate, suitable for papermaking, textile purposes and cordage, either in competition with or as substitutes for the established commercial kinds are also under consideration officially (see Colonial Report, Misc. No. 58, 1909, and *K.B.*, Additional Series ii., "Vegetable Fibres,") and under experimental cultivation in the various Colonies.

TIMBERS.

Detailed returns of quantities and values of different kinds of timber imported into the United Kingdom cannot be obtained except in a few instances for in Trade Returns the various woods are grouped as Furniture Woods, Building Woods, &c.

Douglas Fir, Oregon Pine (*Pseudotsuga Douglasii*, Carr.).

British.—British Columbia, Vancouver. Foreign.—United States of America (Oregon, Washington).

One of the most important woods of Western North America. Used for many purposes, such as light and heavy building work, railway sleepers, paving blocks, fencing, telegraph and telephone poles, furniture, &c. Although inferior to the best Pitch Pine it is recognised as one of the best substitutes for that wood, and it is used for the same work as European Redwood or Yellow Deal (*Pinus sylvestris*, L.). Its most unsatisfactory point appears to be that it does not absorb creosote so well as pine. The tree grows well in the British Isles, and is likely to prove one of the most valuable exotics for British forests. References to the species are:—

1. "The Growth and Management of Douglas Fir in the Pacific North-West," Circular No. 175, U.S. Dept. of Agriculture.
2. "Properties and Uses of Douglas Fir," Forest Service Bulletin No. 88, U.S. Dept. of Agriculture.

See also "Canadian Woods for Structural Timbers," Forestry Branch Bulletin, No. 59, Ottawa, 1917.

Scots Pine, Baltic Redwood, Yellow Deal (*Pinus sylvestris*, L.).

British.—British Isles. Foreign.—Russia, Norway, Sweden, Germany.

The commonest and most generally useful of European timbers. Used for all kinds of building purposes, paving blocks, scaffold

poles, pit props, railway sleepers, telegraph poles, and many other purposes. Substitutes are at present required. Douglas Fir, Lodgepole Pine, White Spruce, Yellow Poplar, or Canary Whitewood, and for pit props probably Mangrove, might be substituted. For further particulars see *K.B.* 1915, p. 274.

Silver Fir, White Fir (*Abies* spp.).

British.—Grown in the British Isles. Foreign.—Norway, Sweden, Germany, Switzerland, Oregon, Washington, California.

Used for carpentry, indoor finish of houses, telegraph and telephone poles (when preserved), toy making, carving, packing cases, and wood wool. Cultivation might be extended in the British Isles, and several species would probably grow well in South Africa and New Zealand. *Abies pectinata*, DC., is the chief European species, and *A. nobilis*, Lindl., *A. Lowiana*, A. Murr., and *A. grandis*, Lindl., some of the principal American species. Other information on White Fir is given in *K.B.* 1912, p. 83.

Spruce, White Deal (*Picea* spp.).

British.—Newfoundland, Canada, grown in the British Isles. Foreign.—Norway, Sweden, Russia, Germany, U.S. America.

Used for indoor finish of houses, common furniture, pit props, scaffold poles, paper pulp, toy making. *P. excelsa*, Link., supplies the bulk of European pulp wood, and *P. alba*, Link, the greater part of that from Eastern N. America. *P. sitchensis*, Trautv. and Mey., from Western N. America, is a valuable timber tree, and is very useful for planting on wet ground in exposed places in the British Isles and in other temperate countries. The wood of this species is used largely in the manufacture of aeroplanes under the name of Silver Spruce.

Lodgepole Pine (*Pinus contorta*, Dougl., and var. *Murrayana*, Engelm.).

British.—British Columbia. Foreign.—Oregon, Washington, S. Alaska. Timber used for general work in America. Might be used as a substitute for Scots Pine here.

American Red Pine, Canadian Red Pine, Norway Pine (*Pinus resinosa*, Soland.).

British.—Canada.

The timber is not considered to be of such good quality as the best Baltic Redwood, but it is used for many of the purposes to which Baltic Redwood is put, and would probably give good results for sleepers, pit props, and paving blocks.

Long leaf Pine, Pitch Pine (*Pinus palustris*, Mill.).

Foreign.—South-Eastern United States of America.

This wood has advanced rapidly in price during recent years, and it is probable that Douglas Fir may be used instead of it in the future for many kinds of work.

Western Yellow Pine (*Pinus ponderosa*, Dougl., and *P. Jeffreyi*, A. Murr.).

Foreign.—California.

The wood is useful for general building work, railway sleepers, pit props, paving blocks, and other purposes. The tree is not likely to be a commercial success in the British Isles, but would probably do well in S. Africa.

White Pine, Weymouth Pine (*Pinus Strobus*, L.).

British.—Canada.

Western White Pine (*Pinus monticola*, Dougl.).

British.—British Columbia, Vancouver.

The timber can be used for general building work and is of good quality. Substitutes are *Pinus koraiensis*, S. and Z., from Eastern Siberia, Korea, and adjoining countries, and *Pinus Lambertiana*, Dougl., from Oregon and California.

Maritime Pine (*Pinus Pinaster*, Soland.).

Foreign.—France, Portugal, Spain.

Although the wood of this tree is not of first-rate quality large quantities are used in South Wales for pit props. The tree is rich in turpentine and resin, and is valuable for planting on sand dunes near the sea. It is the source of considerable revenue in France, particularly by resin and turpentine, and might be grown extensively in the southern maritime counties of the British Isles. For further particulars see *K.B.* 1915, p. 271.

Monterey Pine (*Pinus radiata*, D. Don, or *P. insignis*, Dougl.).

This tree is a native of Monterey, S. California, but it does not cover a large area, and the wood from that region does not affect the timber markets. The species, however, grows with remarkable rapidity in the maritime counties of the milder parts of the British Isles, in S. Africa, Australia, and New Zealand. On this account it is being extensively planted in some places with a view to its wood being used for minor purposes, such as box making, rough fencing, firewood, &c.

Japanese Pine (*Pinus Thunbergii*, Parl.).

Foreign.—Japan.

This is a very useful timber. It can be used for many of the same purposes as Baltic Redwood, and as the tree grows well in the British Isles it might be worth growing under forest conditions.—See *K.B.* 1916, p. 259.

Western Red Cedar, Canoe Cedar (*Thuya plicata*, D. Don).

British.—British Columbia, Vancouver. Foreign.—Alaska, Oregon, Washington.

The wood has good lasting properties, and can be used for build-

ing, sleepers, telegraph and telephone poles, and many other purposes. The tree grows well in many parts of the British Isles, and is sometimes planted under forest conditions.

White Cedar (*Thuya occidentalis*, L.).

British.—Canada (Quebec and Ontario particularly). Foreign.—N.E. United States.

This wood could probably be used for pit props, poles and sleepers.

Californian Red-wood (*Sequoia sempervirens*, Endl.).

Foreign.—California.

Wood useful for building purposes, furniture, shop fittings, and many of the purposes for which pine wood is used. For further particulars see *K.B.* 1912, p. 75.

Deciduous Cypress (*Taxodium distichum*, Rich.).

Foreign.—S. United States.

The timber is useful for building purposes, ventilators, vats and water tanks. It stands damp well. The tree grows well in the British Isles. Other information regarding this tree will be found in *K.B.* 1912, p. 76.

Larch (*Larix* spp.).

L. europaea, DC., grown in the British Isles and imported from Germany, Russia, and probably other European countries. *L. occidentalis*, Nutt., grows in British Columbia, Vancouver, Washington, and Oregon.

Larch is very useful for building purposes, fencing, telegraph and other poles, sleepers, &c.

Larch timber can also be obtained from Canada, Siberia, and Japan. Further information on *Larix occidentalis* is given in *K.B.* 1912, p. 80.

Western Hemlock (*Tsuga Albertiana*, Veitch).

British.—Vancouver, British Columbia. Foreign.—Alaska, Oregon, Washington.

Used for building work, furniture, paper-pulp, &c. This tree is also known as *T. Mertensiana*, and is referred to under that name in *K.B.* 1912, p. 81.

Lawson Cypress, Port Orford Cedar (*Cupressus Lawsoniana*, A. Murr.).

Foreign.—Oregon, N. California.

Yellow Cypress (*Cupressus nootkatensis*, Lamb).

British.—British Columbia, Vancouver. Foreign.—Washington, Oregon.

The wood of both trees can be used for the indoor finish of houses, furniture, &c. The wood of *C. Lawsoniana* is also popular

for match making. Both trees can be grown quite well in the British Isles. For further particulars see *K.B.* 1912, p. 78.

Red Cedar (*Juniperus virginiana*, L.).

Foreign.—United States of America.

The best wood is used for the casings of lead pencils. Rough wood makes very durable fences. One of the most likely substitutes for this wood is *Juniperus procera*, Hochst., from British East Africa. See *K.B.* 1913, p. 221.

Poplar (*Populus* spp.).

British.—British Isles, Canada. Foreign.—Russia, United States of America.

The European species of greatest importance are *P. alba*, L., *P. canescens*, Sm., *P. nigra*, L., and *P. tremula*, L. Of American species *P. monilifera*, Ait., and *P. balsamifera*, L., supply a good deal of wood for export. *P. tremuloides*, Michx., is used in America for paper pulp, and amongst other uses the European *P. tremula* is used for the same purpose. Poplar wood is used for box making, brake blocks, match-making, panelling, flooring, in the manufacture of carts and trucks, &c. The wood of some species splits well, and that of *P. tremula* is imported into the eastern counties for splitting up for the manufacture of baskets for fruit and flowers. Most of the poplars are fast-growing trees, and they might be grown more extensively than at present on wet land or about the banks of streams in the British Isles. Fast-growing hybrids such as *P. Eugenii*, Simon Louis, and *P. marylandica*, Bosc., are specially worthy of note. The wood can be sold at present for from 10d. to 14d. a cubic foot. Evidence of the value of poplar wood for packing cases is given in the United States America Forest Service Circular, No. 47, "Strength of Packing Boxes of Various Woods." For other information about poplar wood see *K.B.* 1911, p. 209.

Willow (*Salix* spp.).

British.—The best willow wood is grown in the British Isles, and a considerable quantity of Willow Rods for basket making is also grown. But in 1913 the imports of Willow Rods from foreign countries were valued at £94,274. The imports were from the following countries:—

	£
Germany	34,246
Netherlands	19,569
Belgium	12,288
Other Foreign Countries	28,171

All the rods required by British manufacturers might easily be grown in the British Isles if proper cultural methods were adopted. A Circular on "The Cultivation of Willow Rods and their Preparation for Market," is published by the Board of Agriculture and Fisheries. The wood of *Salix coerulea*, Sm., is used largely for the manufacture of cricket bats and artificial limbs. It is grown almost exclusively in the British Isles.

Oak (*Quercus* spp.).

British.—British Isles, Canada. Foreign.—Russia, Germany, Austria-Hungary, Japan (including Formosa), U.S. America.

The imports for 1913 amounted to 254,836 loads, valued at £1,736,061. More oak might be grown at home.

Maple, Sycamore (*Acer* spp.).

British.—Canada, and grown in the British Isles. Foreign. —N. United States of America and probably various European countries.

The wood is used for floor blocks, furniture, inlaying, panelling, cabinet work, rollers for washing machines, kitchen and dairy utensils, &c. The best British grown Sycamore realised 2/6 a cubic foot before the war, and is probably worth more now. Information on American Maples is given in *K.B.* 1911, p. 303.

Ash (*Fraxinus* spp.).

British.—British Isles, Canada. Foreign.—United States of America, Hungary, Japan, Manchuria.

Good ash timber is always in demand and commands a good price. It is used for many purposes where strength and elasticity are required. Some of its uses are spokes and felloes of wheels, tool handles, shafts of carts and other vehicles, parts of railway carriages and trucks, agricultural implements, and parts of aeroplanes. The best English Ash (*Fraxinus excelsior*, L.) is that from young, clean, and fairly fast-grown trees. Such wood commands from 2/6 to 3/- a cubic foot as it stands. A great deal more might be grown in the British Isles than is the case at present. Hickory is perhaps the best substitute for ash. For particulars regarding American Ash see *K.B.* 1911, p. 217.

Birch (*Betula* spp.).

British.—British Isles, Canada. Foreign.—Finland, Sweden, Prussia, United States of America.

This wood is used extensively for furniture, box making, shuttles, bobbins, plywood, tea chests, and other purposes. The wood grown in the British Isles is of inferior quality to that imported, but with improved methods of cultivation there is no reason why the quality should not be improved, so that it would compare favourably with the foreign product. Heavy railway freight and the absence of proper marketing facilities appear to have discouraged many owners of woodlands in the proper cultivation of trees for the production of timber. Information upon various birches is given in *K.B.* 1911, p. 221.

Elm (*Ulmus* spp.).

British.—British Isles, Canada. Foreign.—Holland, Germany, United States of America.

Elm wood is used largely for hubs of wheels, chair bottoms, cart building, barrows, boat building, coffins, and other purposes.

English Elm is often low priced on account of much of the timber being hedge or park grown and rough, but it also suffers in comparison with imported wood from the latter being imported cheaply and partly worked. Elm of the very best quality is however, grown in the British Isles, and a great deal more could be produced.

Beech (*Fagus* spp.).

British.—British Isles, Canada. Foreign.—Germany and other European countries, United States of America.

Beech is one of the most generally useful of hard woods. Timber of the very best quality is grown in the British Isles, particularly on chalky soils, and it is probable that all the required wood could be grown in the country. It is used extensively for chair making; is one of the most popular of woods for the backs of brushes, is largely used for the panels of pianos and other articles, whilst it is used for innumerable small articles such as children's hoops, malt shovels, butchers' trays, bowls, spoons, spades, &c. Wood of *Nothofagus* spp., from S. Chile, could be used for some of the same purposes. For other information upon beech wood see *K.B.* 1911, p. 109.

Spanish or Sweet Chestnut (*Castanea sativa*, Mill.).

British.—British Isles. Foreign.—France, Spain, Corsica, United States of America.

The wood is very much like Oak in appearance, and can be substituted for it for many purposes. It is used extensively for heavy building work, fences, and in some places for pit props. Tannin is extracted from the wood in Corsica. The wood of trees below 50 years of age is usually the most valuable when grown in the British Isles, for the wood of older trees is often badly injured by ring shake.

Lime, Linden, Basswood (*Tilia* spp.).

British.—British Isles. Foreign.—United States of America.

The wood is used for sounding boards of musical instruments, carving, turnery, and for kitchen and dairy requisites.

Cherry (*Prunus* spp.)

British.—British Isles. Foreign.—United States of America.

Cherry wood was at one time in great demand for the manufacture of furniture, but it has now been largely displaced by birch, mainly by reason of a regular supply not being forthcoming. If cherry wood were more extensively grown there is reason to suppose that it would again become popular. Much of that at present marketed is used for turnery. Young straight sticks are in demand for walking sticks and umbrella handles, whilst a certain quantity of wood is required annually for tobacco pipes. Information regarding American cherry wood is given in *K.B.* 1911, p. 218.

Box (*Buxus* spp.).

British.—British Isles, South Africa. Foreign.—Caucasus, Asiatic Turkey.

The wood is used for engraving, the manufacture of mathematical instruments, and other purposes for which non-shrinking wood is necessary. Most of the best wood has been imported from the neighbourhood of the Black Sea, but *Buxus Macowani*, Oliv., from S. Africa, also supplies a good timber. Box wood has also been received from Madagascar. Substitutes for Box wood are *Casearia praecox*, known as West Indian or Venezuelan Box wood (see *K.B.*, 1914, p. 214), and Knysna Box wood (*Gonioma Kamassi*, G. Mey.) (see Board of Trade Journal, April 8, 1915, p. 69). From that report wood valued at £3,196 was exported in 1913, mainly to Germany, where it is understood to have been used for the manufacture of shuttles, bobbins, &c. This wood is said to be suitable for engraving.

Walnut (*Juglans* spp.).

British.—British Isles. Foreign.—France, Asia Minor, Persia, N. America.

Used largely as a furniture wood and for gunstocks. *J. regia*, L., is the common species of Europe and W. Asia and *J. nigra*, L., of N. America. The wood is always valuable. Walnut timber may also be obtained from Japan. There are several spurious walnut woods. For information upon American walnut wood see *K.B.* 1911, p. 215.

Yellow Poplar, Canary Whitewood, Basswood (*Liriodendron Tulipifera*, L.).

Foreign.—Eastern United States.

A very useful wood imported into the United Kingdom in quantity and used for furniture and many indoor purposes, often as a substitute for Yellow Deal. Would give good results as a forest tree in the South of England. See also *K.B.* 1911, p. 214.

Hickory (*Carya* spp.).

Foreign.—Eastern United States of America.

The wood is strong, with great elasticity, and is largely used for carriage building, spokes, tool handles, and other purposes for which ash is used. It can be used in place of ash for many kinds of work. The various hickories are dealt with in *K.B.* 1911, p. 304.

Locust or False Acacia (*Robinia Pseudacacia*, L.).

Foreign.—Eastern United States of America, France, and other European countries.

The wood is very strong and durable, lasting well in contact with the ground. On this account it is very valuable for posts, and is used largely for that purpose in America. On the Continent it is grown as coppice for stakes, vine poles, &c. It might

be grown more widely in the British Isles for posts, &c. Trees up to 40 or 50 years of age would probably be more useful than older trees. See also *K.B.* 1911, p. 219.

Persimmon (*Diospyros virginiana*, L.).

Foreign.—Eastern N. America.

The wood is used extensively for weaving shuttles and bobbins, and is said to make a good substitute for box.

Greenheart (*Nectandra Rodioei*, Schk.).

British.—British Guiana. Foreign.—Brazil.

The timber is very hard and durable. It is highly esteemed for use in brackish water, and is perhaps the most widely used timber for piles for wharves, dock gates, &c. It is also a favourite wood for fishing rods. The wood of the Bullet Tree (*Mimusops globosa*, Gaertn.) is said to be sometimes used as a substitute, also the wood of Quebracho Colorado (*Quebrachia Lorentzii*, Griseb.).

Satin Walnut (*Liquidambar styraciflua*, L.).

Foreign.—United States of America.

This wood is used extensively in the manufacture of the cheaper kinds of bedroom furniture. It has also been used for paving blocks, but warps badly in seasoning, and is worthless for the purpose.

Quebracho (*Quebrachia Lorentzii*, Griseb.).

Foreign.—Argentine Republic.

The wood is very strong and durable. It is used for heavy building work, sleepers, piles, dock timber, and can be substituted for Greenheart. Tanning material and dye are extracted from the wood.

Seeds have recently been sent from Kew to several British Colonies.

Mahogany (*Swietenia Mahagoni*, L., *S. macrophylla*, King, and *Khaya* spp.).

British.—West Coast of Africa. Foreign.—U.S. America, Cuba, Hayti, San Domingo. In 1913, 80,995 tons of mahogany, valued at £666,297, were imported from the following foreign countries: Germany, German West Africa, French West Africa, United States of America, Cuba, Hayti, and San Domingo. From the following British Possessions 60,806 tons, valued at £559,582, were imported: British West Africa, Gold Coast, Southern Nigeria, British West Indies, British Honduras. The mahogany from West Africa is usually the timber of species of *Khaya*, and although it is generally inferior in beauty and value to the wood of *Swietenia Mahagoni*, it makes handsome furniture and shop fittings, and is valuable for panelling, &c. There appears to be room for an increase in the trade of West African woods generally. For other African Mahoganies see *Kew Bull.* Add. Ser. ix. part i.

Mangrove (*Rhizophora Mangle*, L., and *R. mucronata*, Lam.).

Widely distributed on low-lying land about the coast line of many tropical countries.

The wood is rich in tanning matter, and an extract is sometimes used for tanning leather. An attempt has been made to popularise the wood for sleepers and paving blocks. It is likely, however, that it may have a better future for pit props. Large quantities can be obtained from the tropical coast of Africa.

West Indian Locust (*Hymenaea Courbaril*, L.).

British.—British Guiana. Foreign.—Brazil.

A hard, tough, and close-grained wood, useful for building purposes and for furniture.

Ebony (*Diospyros Ebenum*, Koenig).

British.—Southern India and Ceylon.

The wood is used for furniture, cabinet work, turnery, piano keys, &c., but is becoming scarce. Substitutes are *D. mespiliformis*, Hochst., from West Africa, and West Indian Ebony (*Brya Ebenus*, DC.), a small tree with dark brown or black heartwood, which takes a high polish.

Other species of *Diospyros* that are useful furniture woods are *D. quaesita* (Calamander or Coromandel Wood), from Ceylon, and *D. Kurzii*, Hiern. (Andaman Marble or Zebra Wood), from the Andaman and Nicobar Islands. In both cases the wood is peculiarly streaked with yellow and black.

West Indian Cedar (*Cedrela odorata*, L.).

British.—West Indies. Foreign.—Northern parts of S. America.

The wood is more popular than any other for the manufacture of cigar boxes. It is probable that this tree would grow well in various parts of West Africa. See also *K.B.* 1913, p. 210.

Red Cedar, Moulmein Cedar (*Cedrela Toona*, Roxb.).

British.—India, Burma, Queensland, New South Wales.

A valuable furniture and cabinet wood, useful for carving, &c. For other Cedars see *K.B.* 1913, pp. 207-224.

Teak (*Tectona grandis*, L.).

British.—Burma, India (cultivated). Foreign.—Java, Siam.

From British India and other British Possessions 38,049 tons, valued at £711,676, were imported in 1913, and from Java, Siam, and other Foreign Countries 9723 tons, valued at £167,578, were imported into the British Isles during the same period.

Teak is cultivated in India, Southern Nigeria, and Togoland, but the supply does not appear to equal the demand; therefore further attention to cultivation seems desirable. The teak plantations in West Africa have not yet reached a marketable age. Substitutes for teak have been suggested, the commonest being

Dipterocarpus tuberculatus, Roxb., and other species of the same genus, the timber of which is known as "Eng," "Yang Teak," &c. This wood is imported from Burma. See *K.B.* Add. Ser. ix. part iii. p. 519.

Jarrah (*Eucalyptus marginata*, Sm.).

British.—Western Australia.

A very hard, heavy, and durable wood of a rich red colour. It is used for paving blocks, counter tops, piling and quay work, sleepers, fences, and other purposes. Posts inserted in the ground have a very long life. For other particulars see *K.B.* 1897, p. 219.

Karri (*Eucalyptus diversicolor*, F. Muell.).

British.—Western Australia.

Used for purposes similar to those of Jarrah.

Blue Gum (*Eucalyptus Globulus*, Lab.).

British.—Tasmania.

The timber is used for heavy building work, as it is very strong and durable, and can be procured in large sizes. This tree and other species of *Eucalyptus* are used for forest planting in S. Africa, British Central Africa, New Zealand, and other countries, but they are too tender for general culture in the British Isles. Further particulars are given in *K.B.* 1903, p. 1.

XXVIII.—MISCELLANEOUS NOTE.

Ceylon Agricultural Leaflets.—A new series of leaflets is being issued by the Department of Agriculture, Ceylon. They are illustrated, quarto in size, and are signed by the writers who are experts in their respective subjects.

No. 3 deals with the Fluted Scale, one of the most beautiful and conspicuous of all scale insects, and No. 2 with Black Rot of Tea. The latter, described by T. Petch, is caused by the sterile mycelium of a species of *Hypochnus*. It is of special interest in that it is a new disease which has apparently only quite recently spread from the jungle to the tea plant. The Shot-hole Borer of Tea, which also attacks several of the plants used for green manuring, is described and illustrated in Leaflet No. 4. Leaflet No. 5 deals with the cultivation of food products, vegetables, and curry stuffs, and should serve to encourage the local cultivation of these products which is so necessary at the present time. The leaflets should prove of considerable practical value.